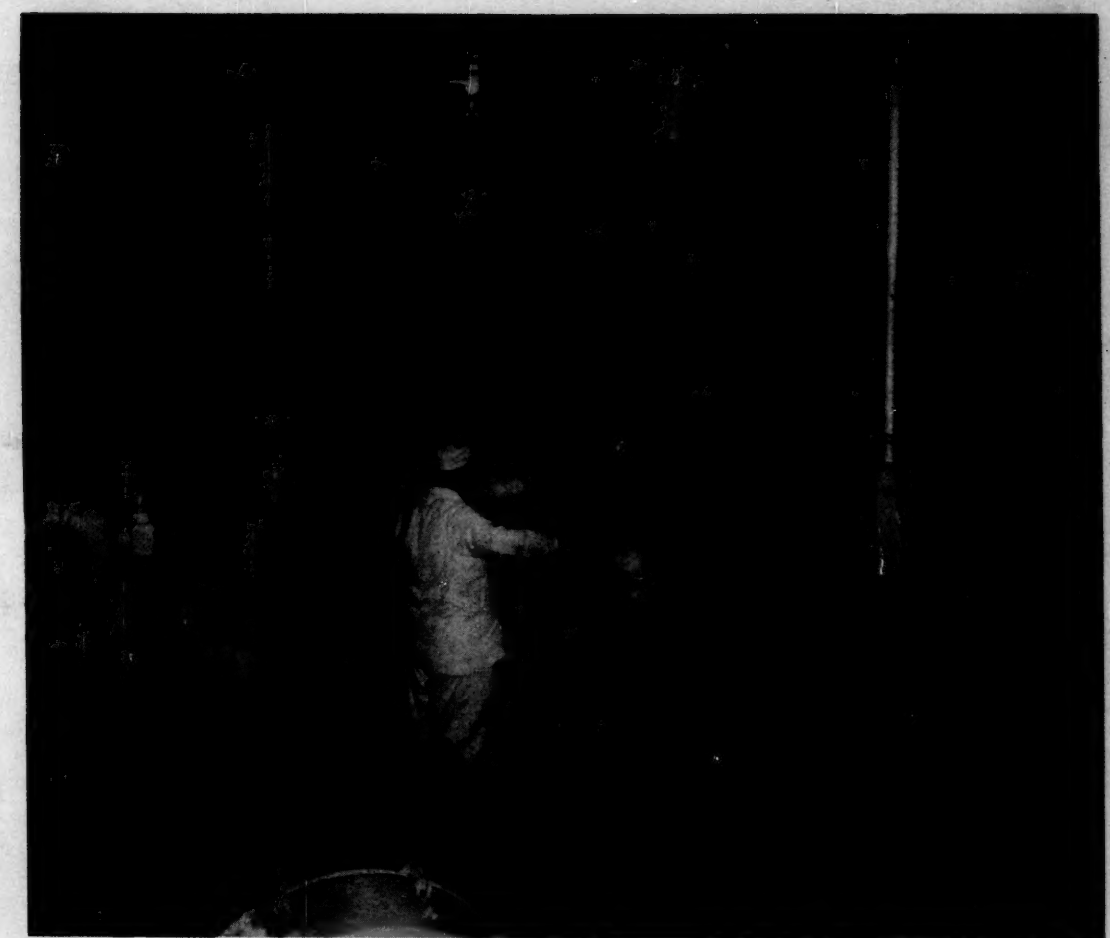
JANUARY
1960

Industrial Refrigeration



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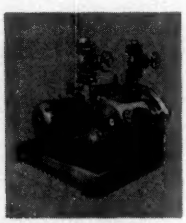
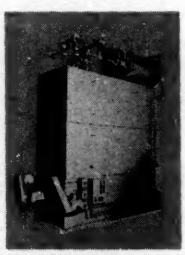


KMV Refrigerant Compressor: 20-200 H. P.



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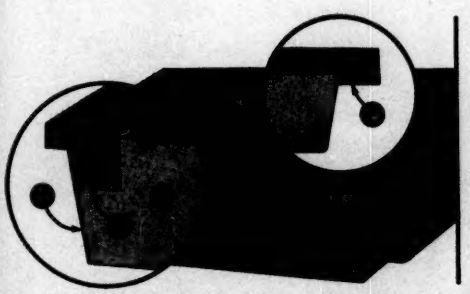

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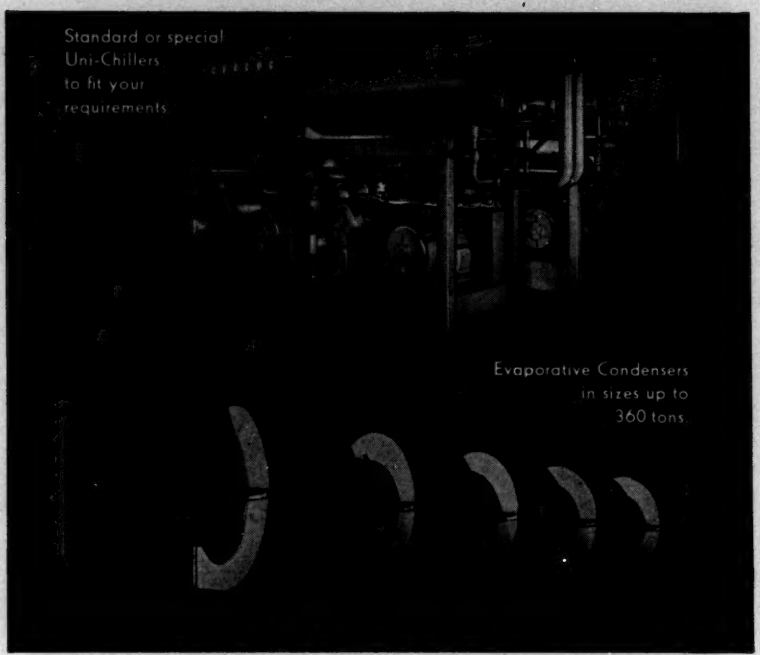

Vilter units for many air conditioning applications are designed to make every dollar count in increased performance, more economical operation, longer life, a more compact installation, and a minimum of maintenance. Years and years of research went into the design of the famous VMC Compressor and Equipment, and this research is continuing at an intensified pace—all aimed at making the VMC Compressor the most durable and efficient on the market.

Uni-Chillers—Each of the special Vilter self-contained units (shown above) consists of two compressors and 75 hp motors, condenser, water chiller and controls. The capacity of each Uni-Chiller is 150 tons. Completely factory-assembled. Compact Uni-Chillers are available in sizes from 10 tons upward.

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Write to Dept. J-986 for helpful Vilter Bulletins on any of the above equipment.

New Technique For Storage Of Blood

»» A NEW technique for the prolonged storage of whole blood has been under development at the laboratories of Linde Co., Division of Union Carbide Corp., it was revealed recently.

The process is expected to eventually revolutionize all present concepts of blood banks. It entails quick freezing of blood to minus 320° F with liquid nitrogen and enables one pint to be frozen in fewer than 45 seconds. Blood frozen by the new technique has been stored for over two years and then thawed, and tests have demonstrated that between 85% and 95% of the blood cells can be recovered with intact complements of hemoglobin.

The Linde research program entered an accelerated phase recently with the decision of the Office of Naval Research to support the work, it was brought out at the conference, which was in the nature of a progress report.

Cost Is Reasonable

Researchers explained that liquid nitrogen was selected as the refrigerant for freezing and storing because it provides the most satisfactory temperature commonly available in a coolant at a reasonable cost and because suitable refrigerators, in sizes small enough to fit in the trunk of a car and large enough to be able to hold up to 400 pints of blood, are already in existance. Large permanent blood bank installations can be built and supplied with liquid nitrogen as soon as the new blood preservation techniques are ready for hospital use, it was stated.

Technique May Also Be Used For Bone Banks

The freezing technique is also expected to have applications for the preservation of bone marrow, tissue and microorganisms.

Company scientists believe "that a process of the indefinite preservation of blood at low temperature is a practical possibility," although, officials cautioned, "it cannot be said that a method for long-term preservation is here, or even close at hand."

Industrial Refrigeration

January 1960

H. T. McDermott
Editor and Publisher

H. D. Busby
Editorial Director

ADVERTISING
O. Rhodius Elofson, *Director*
Edw. Davieson, *Representative*

Helen B. Smith
Secretary

E. P. Swanson
Subscription

V. S. Smith
Production

INDUSTRIAL REFRIGERATION, Published monthly at 433 N. Waller Ave., Chicago 44, Ill., U.S.A., by Nickerson & Collins Co. Yearly subscription in the U.S., $5.00 per year; other countries, $7.50. Single copies, $1.00. Copyright 1960 by Nickerson & Collins Co. Acceptance as controlled circulation publication at Chicago, Ill., and Pontiac, Ill.

CHANGE OF ADDRESS—Notify publisher and your local post office promptly of change of mailing address to avoid non-receipt of copies. Copies incorrectly addressed, because of failure to notify publisher, cannot be replaced. Upon request, post office will provide, without cost, convenient "change of address" mailing cards.

Industrial Refrigeration is indexed regularly by Engineering Index, Inc., and is microfilmed for library use by University Microfilms.

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- **Food Freezing, Storage and Transport**
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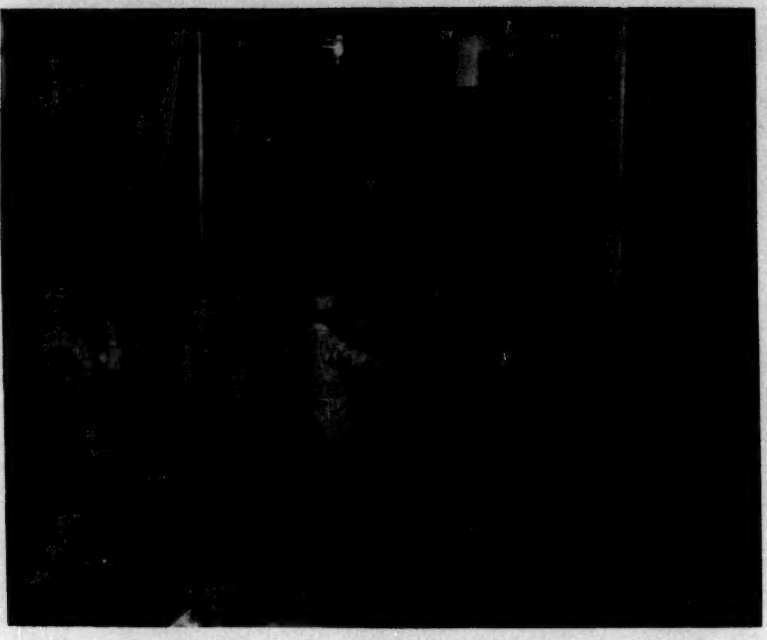
Published Monthly by NICKERSON & COLLINS Co.
General Offices: 433 N. Waller Ave., Chicago 44, Ill.
Telephones: AUstin 7-1303-04-05

69 Years of Continuous Publication



Ice Machines In Yeast Production

»» ANHEUSER-BUSCH, Inc. America's largest producer of beer and one of the largest producers of yeast, has recently installed five Instant-Ice machines at the St. Louis Yeast Plant.

The five machines produce 25,000 lbs. of ice flakes per 24 hours operation. They are so arranged that the ice flakes are fed directly into the yeast mixing and tempering machines when needed. Ice making water is supplied to the units under the plants rigid purity control. Since the ice is used as quickly as it is produced it is pure and sterile.

After thorough testing, Anheuser-Busch selected these machines for the exacting operation of yeast production. Instant-Ice machines and the ice flakes produced met the rigid requirements of their yeast-making specialists.

(1) Ice Flakes must be completely frozen, dry and hard.
(2) Ice Flakes must be uniform in size.
(3) Units must be easily accessible for sanitary inspection and cleaning if necessary.
(4) Durable construction — Dependable operation and consistent high ice flake production.

Formerly block ice was purchased and delivered to the plant loading dock, and from here it was loaded into carts and transported to the third floor storage area. The blocks of ice were thoroughly washed and crushed, and then taken to the mixing machines.

To safeguard the high standard of the products for which Anheuser-Busch, Inc., is widely known, management decided to eliminate all chances of contamination through handling operations.

Quality control was another important consideration; Crushed ice or other ice of irregularly sized pieces will give excess moisture in certain areas and cause blemishes in the finished product. Since Instant-Ice flakes are uniform in size, cold and dry, the chances of blemishes are entirely eliminated.

Yeast has a variable moisture content and constant vigilance is required to keep it in perfect condition during production. Instant-Ice flakes have a controlled moisture weight and a definite latent cooling effect; this fact greatly assists the yeast-making specialist to keep positive control during production. Ice flakes are uniformly distributed and the proper moisture content is consistent through out the product.

The high refrigerating capacity of the ice flakes introduced into the yeast offsets the chemical and mechanical heat generated in the mixing operation. The proper moisture content is quite necessary for the forming of the 1 and 5 pound blocks of yeast in the packing machines. The high efficiency of cooling effect also maintains the finished product at the proper temperature to enter the cooler storage area.

An interesting feature of this installation, beyond improvement of quality control and complete sanitation, is that it has substantially reduced the cost of ice.

The Instant-Ice Machine is designed and manufactured by Liquid Freeze Corporation, Oakland.

Three Associations To Join In Research Study

»» THE Electronic Industries Association and the American Society for Testing Materials have joined with the National Electrical Manufacturers Association in sponsoring an insulation research project at the University of Delaware, it was announced recently by Robert W. Jorgensen, vice president of marketing, plastics division, The Richardson Company, Melrose Park, Ill. Mr. Jorgensen is chairman of the Laminated Products Section of the National Electrical Manufacturers Association.

The joint study will be directed toward developing a reproducible test method for measuring insulating resistance of high-pressure laminates used for electrical circuits or for printed circuitry in aircraft, missile and electronic applications.

Factors to be studied will include accuracy and constancy of both temperature and humidity control. Tests will be conducted in a new climate laboratory test chamber which maintains controlled humidity at different levels and temperatures. Professor M. G. Young, Chairman of the University's Department of Electrical Engineering, will direct the work. Results of the projects will benefit both manufacturers and users of plastic products by producing better understanding of factors involved in measurements of insulation resistance.

ARI Standard For Centrifugal Liquid-Chilling Packages

››› A NEW ARI Standard for centrifugal liquid-chilling packages was published recently by the Air-Conditioning and Refrigeration Institute, the trade association of the industry.

The new standard, numbered 550-59, joins some 40 ARI Standards which have been published as industry guides for refrigeration and air-conditioning products and components.

A centrifugal liquid-chilling package is defined in the new publication as a "factory-designed and prefabricated assembly (not necessarily shipped as one package) of one or more centrifugal compressors, condensers, and liquid coolers, with interconnections and accessories." The standard does not apply to liquid-chilling packages employing reciprocating compressors, but does apply to both open and hermetic centrifugal compressors.

The standard designates what shall constitute "standard equipment" on centrifugal liquid-chilling packages, and provides that, to be in compliance, they shall be "designed, constructed, and shipped with safety devices so as to be in accordance with the latest edition of the American Standard Safety Code for Mechanical Refrigeration (ASA Code B9.1)", as well as with applicable provisions of ARI Standards for Water-Cooled Condensers, and Water and Brine Coolers.

While conformance with the standard is completely voluntary, systems represented as being in accordance with it shall conform to its provisions, ARI points out.

Copies of the standard, which was developed by ARI's Engineering Department under direction of the Centrifugal Committee of the Air-Conditioning and Refrigeration Systems Section, may be obtained from ARI (1346 Connecticut Ave., N. W., Washington 6, D. C.) at 40 cents each.

Fourth Edition Of Safety Manual Available

››› THE National Safety Council has announced publication of the fourth edition of its "Accident Prevention Manual for Industrial Operations."

The completely revised volume is described as "the most complete and informative safety reference work in existence."

A "summation of 46 years of safety experience," the manual was compiled, edited and reviewed by safety specialists. It draws on the knowledge of safety men from nearly 7,000 firms spanning every U. S. industry.

The publication contains more than 500 illustrations and 1,542 pages of up-to-the-minute data on every aspect of industrial safety.

Further information on the all-new edition of the Accident Prevention Manual may be obtained from the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

Portable Ice Vending Stations Can Mean More Sales

››› THE automatic ice vending station illustrated, measuring 10′ x 35′ x 8′, is another of the gigantic one piece portable stations produced by the K. G. Brown Manufacturing Company, Inc. in its modern plant at Mattituck, Long Island, N. Y. It is pictured aboard a Brown truck which carried it to Attleboro, Mass. where it was quickly located on a site of the Attleboro Ice Company by Brown technicians using their own special rigging. It was ready to go to work a few hours after delivery.

The mammoth station, a triumph of Brown engineering, dispenses both cubes and crushed ice, packed in 10-pound bags, as well as 25-pound blocks. Customized to the purchaser's specifications, it is equipped with a 14-foot vendor which delivers in a typical load 138 10's and 50 blocks.

Because it was planned to do double-duty service as a supply depot for smaller stations well removed from the company's ice manufacturing plant, plenty of storage space has been provided. Its reserve capacity approximates 1,500 10's and 50 300-pound cakes. There also is ample room for processing and bagging machinery.

This king-size station may be said to epitomize an advanced concept of ice merchandising, one that is well established in the Northeast and certain other sections of the country, but less so in the states south of the Mason-Dixon line. This concept is solidly based on the axiomatic principle that a "laborer is worthy of his hire" . . . . that a merchant is entitled to a fair price for his product.

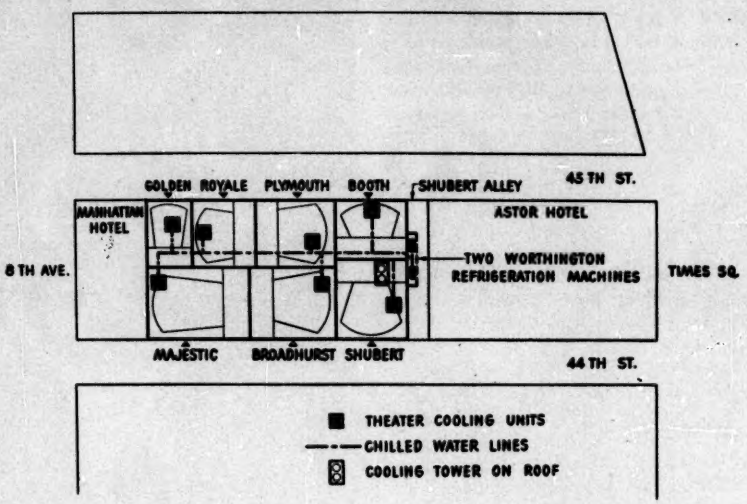
Distributors and retailers of processed ice who presently rely on old-fashioned merchandising methods would do well to reappraise their operations in the light of recent developments in the field, says Kenneth G. Brown, president of the Brown Manufacturing Company and inventor of its line of coin-operated, refrigerated vending machines.

"First of all, ice should be sold profitably, like other commodities," he asserted. "Modern automatic vending equipment not only expands the sales day to a full 24 hours but also reduces labor costs and cuts down product waste. Perhaps even more important, it eliminates face-to-face haggling over price and thus tends to reduce ruinous competition. Costly delivery service becomes a thing of the past in most instances, and without loss of the customer's good will, since he quickly becomes accustomed to serving himself at a conveniently located vending station. In fact he even enjoys the experience."

Seven Theaters Cooled By One System

»»» SEVEN historic theaters, representing nearly one quarter of New York's entire Broadway legitimate theater district, will be mechanically air conditioned for the first time by next summer, it was jointly announced by theater owner J. J. Shubert and Worthington Corporation, makers of the air-conditioning equipment. An ingeniously designed hook-up will link all seven theaters to a master air conditioning system, which will be located out of sight under famed Shubert Alley.

The theaters, whose 7,999 seats, make this installation the largest single theatrical air conditioning installation ever devised, will continue in operation while the installation is going on, with the new system due to be turned on by next spring.



Replaces Ice

The new system replaces ice-chilling systems where up to $6,000 worth of ice a week, in 350 pound chunks, has been required to cool the seven theaters during hot weather. The new system will cost one-tenth as much to operate, according to Worthington engineers, and will not only cool but will regulate humidity and provide the other advantages of air conditioning.

Though the ice system was outmoded, most theaters were closed during the summer and so it was not practical to install mechanical cooling. The Mark Hellinger Theater, which installed Worthington air conditioning five years ago, was one of the first legitimate theaters in New York with mechanical cooling.

Quarter Million Job

Mr. Shubert said final details of the air conditioning project are still being worked out and no cost figure was yet available. He said the job would cost in excess of $250,000 and praised the work of Worthington sales engineers in searching out the most practical solutions to the various problems encountered. Original estimates indicated the job would be considerably more costly, he said.

Pointing out important changes in the nature of the legitimate theater business, Mr. Shubert said such a major project would have been a gamble a few years ago, but was a necessity today. He said two factors have changed the theater into a year round business and made provisions for the summer comfort of patrons a must.

Seven Shubert Theaters on 44th and 45th streets in New York's legitimate theater district will be air conditioned by a central Worthington refrigeration system in the largest theatrical air conditioning installation ever devised. The single system to cool the seven theaters will be installed under historic Shubert Alley. The theaters are the Shubert, Broadhurst, Majestic, Booth, Plymouth, Royale and Golden.

Four of the seven Shubert theaters in New York's Broadway theater district which will be air conditioned in the largest theatrical cooling installation ever devised are shown left. Three others are included in the project.

Mr. Shubert cited first the growth of mail order advance sales and second the growth of theater parties as the reasons. Legitimate houses in the past had a 25 to 30 week season, opening in September or October and running through until the beginning of hot weather the following year, he said.

"In the past virtually all theaters closed for the summer. As recently as 1950, summer operation accounted for less than five per cent of our profits. Last year the figure was 40 per cent. People didn't write in for tickets in the old days, but they do now. Mary Martin (opening soon in 'The Sound of Music') has a two million dollar advance sale. That will carry her into next summer," Mr. Shubert said.

The Worthington engineers will solve the intricate mass air conditioning challenge by installing a 650-ton central refrigeration plant in an abandoned boiler room beneath Shubert Alley. Chilled water will be piped from the central system to cooling units in the individual theaters.

Worthington pumps will also be used to circulate the chilled water to the cooling systems in the theaters and to pump condenser water to the evaporation tower which will be constructed on top of the Shubert Theater.

There will be a constant water flow through the cooling system and the compressors will be able to operate at varying speeds in order to meet load requirements. Compressors operate automatically. Outside temperature changes and varying numbers of persons inside will result in automatic adjustments to maintain constant comfort for theater-goers, he said.

news briefs of the month

"Communicate For Safety" Is New Film

The National Safety Council released a series of four training films entitled, "Communication for Safety", described as a "fresh, realistic solution to the ever-present problem of communication. Here's a proven plan to get your supervisors and foremen to communicate—for safety's sake!"

The films use "everyday supervisor-worker situations, plus an effective combination of live-action photography and clever animation to achieve maximum believability." Available either individually or in series of four, the films come in two sizes—16 mm. sound motion picture, and 35 mm. sound slide film.

Mechanically Refrigerated Dewar Flask

Serfass Corporation have introduced a cold trap which is a mechanically refrigerated dewar flask that eliminates the need for dry ice and acetone and automatically provides temperatures down to −140 F. Weighing but 148 pounds, the mechanical refrigeration unit is attached to the dewar flask by a six-foot long flexible metal hose. All exterior surfaces including the hose vary little from room temperatures. Unlike flasks using dry ice and acetone, the cold trap does not require periodic replenishment of the refrigerant. Unattended it will maintain a preset temperature around the clock.

Refrigerants In Orbit

A chemical originally developed as a refrigerant now is helping keep the nation's Discoverer satellites positionally stable as they spin around the earth collecting data that will help advance the nation's future space programs. Used along with nitrogen to provide the thrust in tiny reaction jet nozzles on the final stage of the Discoverer, the chemical in duPont's "Freon-14" tetrafluoromethane, a compound that boils at minus 198 degrees Fahrenheit. In the satellite's guidance system, it spurts out of the gas jets, providing enough thrust or push to change the altitude of the satellite as it hurtles around the globe at speeds of more than 18,000 miles per hour.

Natural Rubber Is Best For Low Temperatures

If you have had doubts in the past about using rubber in sealing problems at low temperatures such as minus 120 degrees and below, this information will reassure you. Early evidence found by a National Bureau of Standards Cryogenic Engineering Laboratory Group conducting a comprehensive investigation of suitable low temperature seals shows that O-rings made from natural rubber are among the most promising in achieving good sealability at cryogenic temperatures. Preliminary studys have been conducted by Daniel H. Weitzel, Ross F. Robbins and Gordon R. Bopp of the Cryogenic Processes Section.

New Method of Getting High Vacuum

A new method for making extremely high vacuums, some ten-billionths less than normal, is reported by Dr. Jesse W. Beams of the University of Virginia, Charlottesville, Va.

He found the vacuum-producing system while studying the effects of rotors spinning at very high rates in a vacuum. Its advantages include the fact that the extremely high vacuum can be achieved very quickly, and the apparatus can be refrigerated to very low temperatures while in operation. The pumping system, does not use any lubricated bearings, Dr. Beams reports.

Accidents That Shouldn't Happen

Two teen-agers in Milwaukee, Wisconsin were cut recently, one seriously, when a bottle exploded while they were experimenting with dry ice. The accident happened at the home of one of the boys when they put dry ice in a bottle with water and capped it. When gases formed the boy tried to open the bottle but it exploded in his hands. 30 stitches were taken in his face and head. The other boy was treated for chest cuts.

One young man has found that it can be dangerous to climb into the chute of an automatic ice vending machine. He tried it recently in Pikesville, Maryland to release a bag of stuck cubes. He was trapped inside when the door clanged shut. A friend released him by depositing 25 cents in the slot.

How Refrigeration and Air Conditioning

»» AIR CONDITIONING and refrigeration equipment may be divided into countless categories. In the Department of Defense a broad division has been made between equipment installed in a fixed location and that used in mobile equipment or that which is mobile itself. Refrigeration machines which are fixed are part of bases or installations and are the responsibility of properties and installations. Mobile refrigeration machines are used in equipment which is either part of the supply system or part of a weapon system. Such mobile equipment is the responsibility of Supply & Logistics. The list of mobile equipment is a long one and includes air-conditioning for radar, Nike and other missile vans, field kitchen refrigerators, units for conditioning aircraft on the ground, portable ice plants, field cold storage warehouses, air-conditioning units for operating areas in field hospitals, and topographic and photographic vans. Air-conditioning has become an integral part of most of today's complex weapon systems. These systems cannot function without air-conditioning, and it is vital to the proper operation of the weapons systems as any other part. We also find that surface ships as well as submarines are being air-conditioned to produce more effective weapon systems. The electronic systems in many of the large missiles require temperature control, and although this may be done with liquid oxygen or nitrogen, it is still air-conditioning. The air-conditioning for weapons systems is nearly always a non-conventional system. This may range from the liquid nitrogen system of the X-15 to the air cycle system of the missile platform bomber, the B-52G.

In contrast to mobile systems, we usually find air conditioning and refrigeration systems of the conventional type in fixed installations. Since the responsibility of the Office of the Assistant Secretary for P&I is limited to these fixed installations, I will devote the remainder of my comments to this area. In broad terms, one function of Properties and Installations is to establish policy and criteria in the field of construction, and maintenance and operation of real property. One method of insuring adherence to these policies and criteria is through the review of the annual new construction budget before it is submitted to the Congress. A brief look at the magnitude of the air-conditioning and refrigeration in the Department of Defense will emphasize the need for sound policy.

Maintenance Costs High

The value of all air-conditioning and refrigeration equipment and systems in Department of Defense fixed installations is approximately one billion dollars. This is a worldwide figure and includes every type of application from the test hangar at Eglin Air Force Base where an entire aircraft can be placed in a -50 degree Fahrenheit environment to a room cooler in a 60-year old family quarters at Fort Sam Houston. The annual maintenance cost is approximately $40,000,000. Now many of you may believe this cost of 4% to be low, but the total cost for maintenance and operation of real property is approaching two billion dollars annually and this cost is of real concern in the Department of Defense. Accordingly, every effort is made to hold these costs to a minimum.

The policy issued by the OSD is called an instruction and I would like to explain some of the basic points and the reasoning behind these points. First, let me assure you that the Department of Defense believes in air-conditioning and its benefits. In several fields we are probably the leaders in its use. I am thinking of hospitals and training facilities especially. However, because of the tremendous costs involved we have had to specify those areas where we believe the lack of air-conditioning will not seriously affect military operations. In the areas where we believe air-conditioning is essential we have had to determine a priority system so that our limited funds will be applied to the most needed cases first. These restrictions have brought many industry representatives to my desk to register objections about the policy. Usually a definite project at a base is involved. I believe the former Prime Minister of Great Britain, Sir Anthony Eden, described this situation best by saying, "Everyone is in favor of the general economy and the particular expenditure."

In the policy we have established a general priority list which reads:

1. Direct military operational facilities.
2. Hospitals and related medical or dental facilities.
3. Training facilities.
4. Technical and industrial facilities.
5. Indirect military operational facilities.
6. Administrative facilities.
7. Morale and recreational facilities.
8. Personnel living spaces.

By THOMAS R. CASBERG

Mr. Casberg is a mechanical engineer in charge of refrigeration and air conditioning in the office of the assistant secretary of defense for properties and installations. His talk was given before the 11th Exposition of the Air Conditioning and Refrigeration Industry in Atlantic City, Nov. 3.

Is Applied By Department of Defense

For the first 7 categories air-conditioning is permitted anywhere the 67 degree Fahrenheit wet bulb exceeds 1,000 hours during the 6 warmest months of the year. For personnel living spaces the criteria is 2200 hours. I believe these categories are self-explanatory except for the difference between direct and indirect military operational facilities. Direct would include such facilities as aircraft traffic control rooms, flight control centers, pilot alert rooms in or near alert hangars and underground command posts. Indirect would include facilities such as electronic computing rooms, dining halls and communication facilities. This is not a strict priority system. It is expected that the base commander will exercise judgement in selecting projects and that facilities in the higher categories will be considered first. We are pleased by the manner in which this latitude of choice has been exercised. Our selection of a 1,000 hour line was influenced in part by the use of air-conditioning in business and industry, in part by requirement studies, and to some degree by the availability of funds.

Industry Must Lead

Our limitation of air-conditioning in personnel living spaces has not had the concurrence of industry. I do not believe the industry thought this problem through before criticizing this part of the policy. Since we are dealing with public funds we are obligated to be good trustees of these funds. In 1955 we noted that industry leaders were stating only 2 to 3% of the homes of America were air-conditioned and accordingly our original policy did not permit this feature in quarters. We did not believe we could spend the taxpayer's funds for that which he did not have himself. The advent of the Capehart family housing program and the dramatic increase in residential sales indicated a re-evaluation of policy. Where FHA said comparable housing was being air-conditioned, exceptions were granted to so equip Capehart housing. This immediately pointed up a serious morale problem particularly on bases where there were existing family quarters for bachelor officers and enlisted men. Hence, the revised policy issued last November (1958) was based on two points. First, the hottest areas would be conditioned first. Second, all personnel living quarters would be treated equally. To us this appeared to be the only logical approach.

When Cooling Is A Must

A survey of all military housing revealed that $166,000,000 would be needed to air-condition all family housing, bachelor officer quarters, dormitories and barracks where uncomfortable conditions existed at least 50% of the time. This is the 2200 hour line and above since there are about 4,400 hours in the six warmest months of the year.

Air-conditioning in existing structures is considered a modification or alteration and funds for this work are obtained from that maintenance and operation fund which I previously mentioned was receiving close study due to its size. Last year the military departments found it prudent to spend about $20,000,000 for air-conditioning in existing buildings. Now this was not for existing housing alone but for buildings in all eight of the categories I noted before. The lion's share, and rightly so, was spent for air-conditioning of military operational facilities, hospitals, dental clinics, classrooms, technical facilites and administrative areas. I believe you can now understand, considering the hottest areas first criterion, why we don't have to be concerned with the 2200 hour limitation for several years. Even if the entire amount was spent for air-conditioning of quarters, it would take eight years to reach the 2200 hour line.

Our use of the 67 degree Fahrenheit wet bulb has also caused much comment. It was picked for several good reasons. It is a simple criterion which is easily understood. This is important when dealing with laymen especially in the comptroller's office. Equally important was the availability of data at this point. Extra funds were not spent to compile new data. The wet bulb is a measure of total heat and so we agree with Mark Twain that "it ain't the heat, it is the humidity".

We consider the desert area of the Southwest to be a different problem and use evaporative cooling in this section of the country unless close control of humidity is required and then we use mechanical refrigeration, of course. We have recognized a climatic anomaly in southern Arizona where a high wet bulb requires the use of mechanical refrigeration even in housing.

We do not issue a map because it would be inaccurate and misleading. A difference of 15 or 20 miles can often account for substantial differences in climate. This is especially true near mountain ranges and rivers. We insist on weather data compiled and issued by meteorologists and on their advice use a minimum period of record of 5 years.

Wary Of Low First Cost

The objective of the Department of Defense policy is to obtain the best systems at the lowest costs consistent with long terms maintenance and operational costs. We believe the maintenance and operational costs are quite important. The increasing requirements of our steadily aging facilities indicate that less, not more, of the maintenance and operation budget will be available to add systems to existing buildings. For this reason I believe neither the industry nor the DoD benefit from so-called "low first cost jobs" which have high long-term maintenance and operation costs. The funds for next year's new system in another building will be consumed by the Maintenance and Operation hog which

was sold to us with a low price tag as camouflage. At this time when we are adding air-conditioning at a very rapid rate it is important that we consider M&O costs 5, 10 and even 20 years from now.

Central Systems Preferred

Associated with the objective of low cost long-term maintenance and operation is another widely discussed segment of our policy—the use of central systems and the prohibition of multiple units. All of our studies and all data we have obtained from the industry indicates that only a central system is capable of quality air-conditioning coupled with long-term low cost maintenance and operation. Walter Reed Hospital in Washington was an example of the wastefulness of multiple units.

At one time there were 832 separate condensing units in this building complex. About 37 different manufacturers were represented. When I talked with the maintenance foreman about spare parts a wild look came into his eyes. The Commanding Officer expected him to be able to make emergency repairs on practically all of the units and the supply system would not keep an item in stock if there was no activity for 6 months. As a side point, it is interesting to note that some of the most critical areas are not concerned with people but with animals. A failure of the air-conditioning for the monkeys could ruin months of research work. A central system is now being installed.

It has been stated that the DoD policy prohibits room coolers and packaged units. This is not true. We have many installations of each. Many houses have only one bedroom cooled and this is logically accomplished by a room cooler. There are many small offices in non-conditioned facilities such as warehouses and automotive shops where room coolers are used. The Department of Defense has countless small buildings where a single package unit, either DX or chilled water, is the central system for the building. There are also examples of two or three systems in a facility instead of a central system but these are exceptional cases. It is believed that each project should be studied separately and sound engineering applied. When exceptions are really necessary the policy provides for such unusual cases.

There are several general problems confronting us at this time which I would like to present with the hope that the industry can help. It is my opinion that the solution will benefit industry as well as the Department of Defense. Most if not all of the solutions apply equally to similar non-military problems.

Hospital Problems

Hospital air-conditioning and the prevention of the spread of infectious organisms by such systems is a very important current problem. A solution is needed not only for new hospitals but indications are that modifications are needed in existing hospitals. Time Magazine of October 12, 1959, pointed out that hospitals are now the major source of fatal infections. The people of Houston will not forget last year's tragedy when a number of infants died in one sweep of a hospital originated infection. The medical profession has used the term "fearful epidemics" to describe the results of lack of control of antibiotic-resistant organisms such as staphylococci in hospitals. Medical authorities, both military and civilian, are blaming air-conditioning systems for part of the problem. An AP report from Detroit in the September 13, 1959 papers quoted Dr. W. N. Glas, Director of Surgery at Wayne County General Hospital, as saying, "steps must be taken to prevent the spread of infectious organisms by hospital air-conditioning systems". The problem is partly cleanliness. It seems to be necessary to be able to get in, around and behind any air-conditioning equipment in patient rooms in order to scrub, wash with chemicals or perhaps steam the equipment. So far the only suggestion is merely an evasion. The proposal is 100% fresh air for the entire hospital through a double duct system. The industry is much more ingenious and can recommend a better solution which is reasonable in cost.

The present ARI certified program is good and very helpful not only to Department of Defense but to all Government agencies. Major General Minton, Director of Civil Engineering of the Air Force, has spoken highly of the program. In the near future the Air Force will probably include ARI certification in their specifications for family housing. At the Air Force air-conditioning conference in July, General Minton expressed the hope of the Air Force that the certification program would be substantially expanded to include heat pumps, larger units, components and related equipment. Such an extension of this program would be beneficial to the entire Defense Department and it would be encouraging to hear of such plans.

Architecture Need Engineering

The industry can provide much needed assistance in the big problem of design criteria. Many of you are probably thinking that you are not involved in this problem. I hope to show you that you are surrounded by it. The air-conditioning of family housing is a good example. The practice in the Capehart housing program is to engage local architect-engineers for each base. It has been noted that not too many A-E firms have had experience with house air-conditioning. Many times there is plenty of architecture but not much engineering. As a result there are troubles. It must be emphasized that the A-E is quickly forgotten but your nameplate is permanently attached to your equipment and could be the object of a never-ending verbal abuse. Frequently the Base Commander and other senior officers live in these houses and being laymen in air-conditioning, associate the troubles with your nameplate. You don't want that kind of reputation. Many fine pieces of equipment are damned because of poor application. Noisy and improperly placed grills and ducts, poor thermostats locations, undersized or blocked cooling towers, poor access for maintenance and many other design failures of omission and commission can reduce the value of good refrigeration equipment. The matter of access for maintenance is important to all. Unfortunately, there is housing at a southern base where

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By HAROLD J. HUMPHREY

Text of talk by Harold J. Humphrey, General Foods Corporation and president of the National Association of Frozen Food Packers, given before the 11th Exposition of the Air-Conditioning Industry, Atlantic City, N. J., on November 3.

The Future of Refrigeration In Frozen Foods

>> THERE is a tremendous amount to learn about refrigeration, air conditioning and frozen foods. These three fields offer a real challenge to the inquisitive and resourceful engineer or scientist.

And we must admit that scientists and engineers are resourceful, so resourceful in fact, that when they found they couldn't open the window, they air conditioned the train.

To talk intelligently about the future of anything implies that you know not only where you are but also where you have been. This applies particularly to frozen foods which is a young and vigorous industry.

The control of temperature in the preservation of food has been a major factor in revolutionizing the food industry. But long before the recent dramatic developments in this field, man had discovered the important general relationship between low temperatures and food preservation.

Sharp freezer rooms in cold storage warehouses, using mechanical refrigeration with temperatures about minus 20 degrees Fahrenheit, were first used about 1908. Until this time, the concern had been with low temperatures and not the speed with which those low temperatures were achieved.

In 1916, Dr. Plant of Germany demonstrated by means of laboratory experiments the advantages of the rapid freezing of meat. Here was probably the earliest introduction of the time factor in combination with low temperatures to preserve food quality.

So from an era in which the value of low temperatures had been limited to the preservation of food simply to keep it edible, we moved into an era concerned with preserving food with its original flavor, color, texture and peak nutritive values.

Young Industry

But the era of quick freezing is a new one. Only last June an anniversary dinner was held in Springfield, Massachusetts, marking the thirtieth year that frozen foods were made commercially available to the public. It was a New Englander from Gloucester who first applied scientific principles to the rapid freezing of foods. That Yankee, of course, was Clarence Birdseye.

In the same year that Dr. Plant was showing the advantages on a laboratory basis, Clarence Birdseye was developing the same idea through actual experience.

In 1916, Birdseye was in Labrador for the United States Biological Survey. He was fishing through the ice one day and quite successfully. The fish he caught froze almost instantly. He brought them back to camp and sometime later, had them cooked and found they were as delicious as fresh fish.

Up to that time, frozen fish—that is fish which had been slow frozen—when cooked became watery, unattractive and almost unpalatable. It was from that time on that Clarence Birdseye became interested in quick freezing. He is, of course, recognized as the acknowledged founder of today's frozen food industry.

While we speak of the thirtieth anniversary of the introduction of frozen foods, the fact is that most of the early years were spent in experimentation coupled with great investment in establishing a distribution system. And this in itself was quite an achievement.

A New Field

The introduction of frozen foods was not just another new product to be added to the list of those being sold in the usual way through the usual channels. This was no problem of merely fighting for shelf space in a retail store. This meant creating an entirely new system of distribution.

It meant providing freezer space in stores. It meant providing new refrigerated warehouses capable of holding frozen foods. It meant providing trucks and railroad cars which could maintain frozen foods at zero degrees Fahrenheit. And most important of all, it meant selling a new idea to the consuming public.

The thirtieth anniversary dinner last June fifteenth honored some twenty-nine men and women who were the first purchasers of the

new frozen foods and the only one of the ten pioneer grocers who is still in business at the same location in Springfield, Massachusetts.

That grocer and those early users of frozen foods were real pioneers. They took a chance on something new when they put down their good money for food preserved by an unknown method.

I have delved into this bit of history because frequently, we have a tendency to think that something which now is obviously successful has been with us always.

At the risk of telling you something about the frozen food industry which you may already know, bear with me for a few more statistics which I believe are germane to the subject.

Equipment Needed

As recently as 1948, there were only three mechanically refrigerated freight cars in operation. Ten years later, that is in 1958, there were about twenty-four hundred mechanically refrigerated cars in service, and 1400 on order—all of which are capable of maintaining zero degrees Fahrenheit.

There are more than thirty-four thousand refrigerated trucks which now carry frozen foods throughout the country.

Home refrigerators are built with freezer compartments as a matter of course today. In fact, you would find it difficult to buy a refrigerator without a freezer compartment. During the first eight months of 1959, sales of domestic refrigerators were 2,551,000.

Separate home freezers have joined the ranks of universal major appliances. Over a million were bought in 1958 and the first eight months of this year the figure is 886,000. According to government figures, there are about eleven-and-a-half million home freezers in use and four-and-a-half million commercial freezer lockers used largely by individual consumers.

The new frozen food industry had an effect on agriculture. Many farmers have found new economic stability in being able to contract for the sale of crops even before they are planted. New and special seed strains have been developed by frozen food processors. Farmers have been shown how to extend their markets by the addition of other crops.

In 1939 the industry packed 325 million pounds of frozen food. In 1958, production of frozen food was running at the rate of from six to seven billion pounds valued at two-and-a-half billion dollars.

From the time of the first packer thirty years ago, there are now about one thousand processors.

At first, people hailed the new process as a way to enjoy strawberries in January. Over the years, however, the emphasis has shifted to the far more significant fact that quick freezing now makes it possible for millions of Americans to enjoy farm-fresh fruits, vegetables and other seasonal foods the year around.

People in every section of the country have been introduced to new foods from artichoke hearts to southern okra and black-eyed peas. And mind, this is to say nothing about prepared foods such as turkey, pot roast, and chicken dinners, let alone frozen chow mein, lasagna, or that great American delicacy—pizza pie.

Now what are the implications of this tremendous increase in the volume and variety of frozen foods? Obviously, it means there must be some standards for their handling. And when we in the industry talk about handling frozen foods, we mean handling at zero degrees. Too many people think that because a food package may be cold, hard and thirty-two degrees Fahrenheit, it passes muster as a properly controlled frozen food. This is not so.

The quality of frozen foods suffers when exposed to elevated temperatures for varied periods of time. True enough, there are variations in characteristics among the hundreds of foods frozen. But the loss of quality at temperatures above zero varies with the product.

Let me explain. Almost all frozen foods require zero degrees to maintain quality. However, there are a very few which do not lose quality when exposed to higher temperatures for reasonably short periods of time.

Nevertheless, it was apparent early in the game that for distribution purposes, zero degrees was the best temperature to use for all products. It would not be feasible to distribute at several different temperatures.

And the picture is becoming even more complicated with the increase in the sale of prepared foods. Here new and more critical problems are created because of the combinations of different items in one package.

A great deal of research has been done on the subject of temperatures as they affect the quality of foods. Most important has been the excellent work started in 1948 and continued since at the Albany California Laboratories of The United States Department of Agriculture. This project is known as the Time-Temperature-Tolerance of Frozen Foods. Its purpose was to develop comprehensive information on the effects of temperature hazards on color, flavor, vitamin content and other quality factors of frozen foods. The results of this work have been published in a series of technical papers now totaling nineteen.

Task Force Formed

After publication of these studies, another major development took place in the industry. An all-industry task force was formed whose aim was the encouragement of maintaining proper temperatures throughout the distribution cycle —from the processor to the retailer.

The National Association of Frozen Food Packers spearheaded this movement. Representatives from government railroads, truckers, distributors, retail grocers, food chains, warehouses, the Florida Citrus Commission and the National Fisheries Institute among others, are all part of the all-industry task force.

This group meets twice a year to discuss primarily what each segment of the industry has done in its area to improve the handling of frozen foods. That they have accomplished a good deal in a very short time is attested to by the National Association of Frozen Food Packers' publication of a list of more than fifty educational booklets and other material—almost all published since 1957. Incidentally, our Association serves as the clearing house for all this material.

Establishing standards for han-

dling frozen foods is not a new idea at all. When frozen foods were first introduced commercially thirty years ago, there was considerable thought given to improving their handling by forward-looking people. In the literature of that period, you will find references to meetings held to discuss better practices in distributing and handling frozen foods.

As the years have passed and frozen foods have become an important part of the American kitchen, there has been an improvement in handling and now an attempt to establish uniform standards for the entire industry throughout the country.

A little over three years ago, another important development took place in the frozen food industry. It was a development which again spoke for the good spirit of cooperation among all segments of the industry.

Standards Developing

It was evident to regulatory officials as well as many people in all phases of the industry that standardization of frozen food handling was necessary and inevitable. Very wisely, responsible government officials realized the complexity of the problems involved and the specialized knowledge needed to provide sound and reasonable direction for all in the industry.

In May, 1956, the Association of Food and Drug Officials of the United States invited the National Association of Frozen Food Packers to work with them on the development of a uniform code covering not only the maintenance of temperature, but standards of sanitation, performance and quality. The aim was, of course, to do the job which needed doing and to do it in a way that would be fair to all.

Now, on the whole, I think products at the processors' plants are maintained to insure the best quality. But processors lose control of the product when it leaves their plants, for in almost all cases frozen foods are transported in equipment not owned by processors.

I believe our transportation companies do a good job in moving frozen foods. But look at it this way: a truck or railroad car loaded at the processor's plant is only the beginning of the distribution pattern. The products can move into a public warehouse. From there the products can move into another more locally situated warehouse and then even to a customer's own storage area before being transported to the store.

What I am saying is that the more movement from place to place, the greater chance for temperature variations and most likely elevated temperatures will result.

Now, what does this proposed uniform code really try to do? It has one objective — that is, to see that all frozen foods are handled at temperatures which will protect the high quality of foods preserved by quick freezing. It proposes that the handling of frozen foods at zero degrees throughout the distribution cycle will maintain quality and keep the consumer coming back for more.

Where are we now as far as frozen foods are concerned?

The United States Department of Agriculture's biennial warehouse census, last compiled in 1957, showed there were about 333 million cubic feet gross in zero-and-below storage space. Ten years earlier only 145 million cubic feet existed.

Freezer Market

Freezer cabinets are being installed at a greater rate than ever before. The average installation for super market Institute members shows that in the past five years the lineal feet per store has doubled. In 1954, the average installation of freezer cabinet was 55 lineal feet; in 1958 it was 100 lineal feet. And this is for frozen food use only and exclusive of ice cream.

It was also reported that in 1958 new stores with up to ten thousand square feet of selling area installed an average of 61 lineal feet of frozen food cabinets; those with a selling area of ten to fifteen thousand square feet of selling area installed an average of 96 lineal feet of frozen food cabinets and those with over fifteen thousand square feet installed 130 lineal feet.

According to an article in the Progressive Grocer, a new small store, or a rebuilt one, may not have a fresh meat cabinet but will have a frozen food cabinet.

Earlier I mentioned that there were about thirty-four thousand refrigerated trucks which now carry frozen foods throughout the country. Some statistics provided by the U. S. Department of Agriculture reveal some of the problems in this area of the distribution cycle. Of these thirty-four thousand trucks, about five thousand can hold zero degrees Fahrenheit; fifteen thousand hold up to ten degrees; ten thousand five hundred with an average up to eighteen degrees and thirty-five hundred delivery trucks that have temperatures up to 25 degrees or higher.

You can see from these few figures that holding zero degrees presents problems in the movement of goods by trucks.

Refrigerated Trucks

Admittedly, it would be a very difficult task to have these trucks which do not hold zero reworked overnight so that they will maintain zero temperatures. But, beside the proposed uniform code and the emphasis on the maintenance of proper temperatures, something will have to be done. Better equipment and more refrigeration is needed.

There are some things which, if observed by those in the transportation industry, would help to improve present equipment without the expenditure of large sums of money.

For example, refrigerated trucks have drain holes which carry off liquid used to clean out the interior. In many instances, the plugs for the holes are either lost, strayed or stolen. When a truck is running along at fifty miles an hour or better with an outside temperature of seventy degrees, the inside temperature of the truck cannot help but be elevated.

Sloppy seals or poorly welded seams drive air into the truck body like a blast when the trucks are moving at high speeds.

Floor racks and side racks which allow circulation around the frozen food shipment are necessary if proper temperatures are to be maintained. The absence of racks

will prevent circulation of air around the goods and elevated temperatures cannot help but result.

But transportation is not the end of the problem. For when the products arrive at the store, another set of conditions are at hand. Here we are faced with both the problems of adequate backroom storage and proper temperatures in freezer display cabinets.

In a survey made by the Association of Food and Drug Officials during the first four months of 1958, 6,999 display cabinets were checked in 3,063 stores in 34 states and the District of Columbia. This is an average of two-and-a-half cabinets per store. Some of the figures were quite revealing.

For example, about one-third of the stores had no backroom storage facilities; in the remaining two-thirds which had backroom facilities, only about half maintained temperatures from minus five to zero degrees; about 21 per cent had temperatures from one to five degrees and the balance six to 26 degrees or higher.

In checking display cases, packages were above the frost line in 32 per cent of the stores checked with about two-thirds storing their frozen foods properly.

From the foregoing figures, I believe you can see the need for adequate backroom storage and for education on proper storage in display cabinets.

I have attempted to give you a quick review of the frozen food industry—its history, some facts on where we are now and the importance of having proper refrigeration equipment all along the line to insure the quality of our product.

Now, let me put on my seer's hat, place the crystal ball on the table, turn clairvoyant and stick my neck out quite a distance. I understand this is the right way to make predictions about the future of almost anything.

I think the frozen food industry will continue to grow in the future as it has in the past. It is practically axiomatic then, that the refrigeration industry will have to also continue to grow to keep pace with the frozen food industry.

The requirements of the proposed AFDOUS code and the maintenance of zero temperatures throughout the distribution cycle —from processor to the ultimate consumer means that new refrigeration will be needed particularly for trucks, backroom storage in retail stores, retail cabinets and of course home refrigeration.

Specifically, citrus juice concentrates and vegetables will continue their upward rise.

In the immediate future, prepared foods will be the "spectaculars" of the industry. Production forecasts comparing 1959 with 1958 have already been made. Frozen platters will be up thirty-five per cent over 1958; entrees twenty-eight per cent; fruit pies twenty-five; bakery products and nationality foods up about twenty per cent.

Generally, it is accepted that prepared products will increase twenty to twenty-five per cent this year over 1958.

Another interesting development is occurring in the meat industry. For the most part, packers have had animals shipped over long distances to central slaughtering areas and then distributed from those points.

Now, meat packers are moving their slaughtering operations closer to the areas of production, preparing meats in packaged form and distributing from these preparation points. This will mean the use of low temperatures to a much larger extent in this industry. This, of course, complies with the increasing demand from retail stores for pre-cut and pre-packaged meats.

In the next three to four years, total frozen food production should be between eight-and-a-half and nine billion pounds, an increase of one-and-a-half to two billion pounds.

From the foregoing projections, I think you can see the pressing need for adequate refrigeration.

You have in frozen foods a way of preserving at peak flavor, full nutritional value and natural color. These are merchandising aids which are built in the product.

The United States Department of Agriculture had this to say about frozen foods.

The frozen food industries have established high standards and new concepts of quality which are important in merchandising. They are basic reasons for consumers' purchases—the real reasons for the success of frozen foods.

All of us in this business have a boss. That boss is Mrs. Consumer. She had demonstrated throughout the years that she likes and wants the high quality of frozen foods.

The high quality of frozen foods is maintained by keeping the products at the proper temperature throughout the distribution cycle . . . and that proper temperature is zero degrees Fahrenheit. If this quality is diminished by not observing proper handling, Mrs. Consumer will stop buying frozen foods.

You gentlemen in the refrigeration industry are an important part of the frozen food industry. It is your resourcefulness, ingenuity and engineering ability which provides the equipment which will help us maintain frozen foods at the temperature needed for top quality appeal.

Booklet Tells How To Insulate Trucks

»» A 12-PAGE illustrated booklet providing detailed information on the efficient insulation of refrigerated truck bodies and trailers as well as air conditioned vehicles has been published by the Insulation Division of the Armstrong Cork Company.

One problem that has plagued truckers and truck manufacturers for years is the increased weight and loss of insulation efficiency through air infiltration and moisture accumulation. In some instances, weight increases have been as high as 4,000 to 5,000 pounds in two years of service.

The 12-page brochure deals with methods of eliminating air infiltration, the use of air barrier treatment and general considerations in insulating refrigerated bodies.

The booklet also describes various types of material that are available for more efficient insulation of refrigerated cargo trailers and truck bodies.

Trends In Heat Pump Application

By WILLIAM H. DEVINE

York Division,
Borg-Warner Corp.

In citing some of the successful applications of heat pumps in large buildings of all types, the author of this article also points up the conditions under which the heat pump can be most successfully applied. This paper was presented to the Air Force Conference held in Dayton, Ohio, July 1959.

»» LET'S look first at some of the reasons for the widespread belief in the tomorrow of the heat pump.

You are certainly familiar with many of the usual concepts that created the interest in the heat pump. Space, where the heat pump requires less space than the combined total of the heating and cooling equipment normally required for a building. Convenience, where the heat pump will shift from heating to cooling automatically as required by climatic conditions. Clean, with no fossil fuels burning in the residence or building and the atmosphere and the interior of the building are both cleaner. Safe, again with no open flame present in the residence or building the heat pump is a safer installation than the usual fossil fuel fired system.

One set of equipment, rather than two sets as normally required, also makes a good deal of sense and leads toward economy of first cost and economy of operation.

Perhaps one of the most salient of the heat pumps attractive features is its ability to provide simultaneous heating and cooling. Most good air conditioning systems not only provide heat in the wintertime and cooling in the summertime, but they provide heating and cooling simultaneously for control purposes during almost the entire year. This is necessary when you realize the sun shining on one side of the building can result in a cooling requirement, while on the shady side of the building heat would be required. The conventional system supplies the heat from a fossil fuel fired boiler perhaps, and produces the cooling effect with an electrically driven refrigeration system. Thus, we are adding heat to the building while at the same time we are removing heat from it. The heat pump, of course, is quite capable of taking heat from one side of the building (the sunny side) and moving it over and using it on the shady side of the building (cooling).

"Fuel by wire" is coming more and more into use. Electrical distribution that works certainly seemed to be the most economical way of converting the heat supplied by coal, or gas, or oil, into useable power. Looking at tomorrow again, the first nuclear reactor is producing electric power for commercial use in the shipping port plant outside of Pittsburgh. Certainly, the best way to use the electric power produced by atomic energy, at present, is with a heat pump. Not only that, but a break through has been made recently where electrical energy is produced directly from atomic nuclear fission. This again would point to still further use of the heat pump in the future.

Now, for heat pumps today. This paper deals exclusively with air source heat pumps because we, along with most of the industry, believe that the water source heat pump has rather limited application. Air is always available and makes a very excellent heat source, although it is somewhat less efficient in operation than a water source system. This paper also deals principally with central station heat pumps, although we will touch briefly on package systems.

The central station air source heat pump is a practical and useful application. York Corporation has now in operation more than 8000 tons of central station air source heat pump. These installations cover all types of buildings along with industrial plants and even skating rinks. Let us look at a cross section of typical heat pump applications to see the types of buildings where heat pumps can be best applied. Probably the first qualifying point to investigate is the heating to cooling load ratio. If the ratio of the heating load to the cooling load (both in btu per hour) is less than 1.0 it is likely that a heat pump may be applied to the building with resulting favorable operating cost. The reason that the heating to cooling load ratio is a good qualifying factor is that the refrigeration equipment generally produces less capacity on the heating cycle than on the cooling cycle and, therefore, a lower heating load favors the heat pump. As with any gas pump the higher the lift in pressure across the pump the lower the capacity considering the pump to have a fixed displacement.

Talking about heating to cooling ratios of less than one may surprise some people since in the

past the heating load has generally been larger than the cooling load. Modern buildings are reversing this past pattern with larger cooling loads. Careful load calculation will very often show a load ratio favorable to a heat pump.

A laboratory building using large quantities of outdoor air would seem at first to be a poor heat pump application. The Sylvania Laboratory outside of Buffalo, New York, where a 200 ton compound air source heat pump is giving a good account of itself, shows it to be a good application. Laboratories and other buildings using large quantities of outdoor air can be heat pump applications if suitable heat exchange is provided between exhaust air and supply air.

Buildings with high internal heat load are usually good heat pump applications. Two typical examples are the 450 ton installation at the Heironimus Department Store in Roanoke, Virginia and the 550 ton installation in the Columbus and Southern Building in Columbus, Ohio. Department stores and office buildings usually have high internal loads, particularly with the ever increasing use of lighting and office machinery.

Plant Applications

On the other hand a manufacturing plant with 24 hour occupancy could be a good application for a heat pump as is the 600 ton York compound air source heat pump at the Flick-Reedy plant outside Chicago. The 600 ton heat pump installed in Flick-Reedy is comprised of three parallel systems each of 200 tons cooling capacity. The three compressors used are of two different types—the low stage compressor used only for heating duty in compound operation is a rotary type compressor with a 125 horsepower motor, while the other two compressors used both for heating and cooling duty are reciprocating machines, one an 8 cylinder and the other a 12 cylinder. The compressor horsepower required for cooling, the two V/W machines, totals to 175 horsepower for slightly over 200 tons capacity. This is usual in heat pump applications since the outdoor air cooler is generally sized for the heating application it is amply large for the cooling application with the resulting lower brakehorsepower per ton on cooling. The reason for the apparently large total horsepower here is that each of the machines is motored according to its most severe requirement. During the maximum heating load, for example, the rotary compressor will be drawing substantially less than its 125 horsepower would indicate, as with both of the high stage machines. However, the machines must be motored for the most severe duty which is generally pull down.

Super Markets

Super markets generally are good heat pump applications. They have high internal loads — some modern supers have as much as 10 watts per square foot in lighting which is almost enough heat in itself to take care of the markets requirements. Most super market applications have been done with multiple small packaged heat pumps. In one installation supplementary electric strip heaters were provided with the packaged heat pump units and were so interlocked with the store lighting that the strip heat or the lighting could be used as an auxiliary heat source but both sources could not be used simultaneously.

Equipment used in heat pump applications varies according to the requirements of the particular installation. York Corporation now has available three types of heat pumps—the custom built installation such as the one used at the new office building of the Public Service Company of New Jersey outside of Camden; the factory assembled central station system and the packaged heat pump.

Most of the smaller heat pump installations up to 25 or 30 tons will be handled by the packaged heat pump in single and multiple installations. An example is the York Model HP36. They can be located practically anywhere, either indoors or out or half way in between. The casing is weatherized so that no additional housing is required for outdoor installation —the casing is insulated too to minimize heat losses when the unit is installed outdoors.

The York central station air source heat pump can be supplied as a custom built system or as a factory assembled system. The custom built system has the usual advantages of a system engineered for a specific job. The components are balanced for maximum operating economy for the particular job and are sized exactly for the calculated loads. Also, the custom built system has no particular size limit and it can be adapted to job conditions as necessary. An interesting example of the York custom built heat pump is the installation at Squaw Valley, California, the site of the 1960 Olympics. Here the heat pump takes heat from the ice rinks to heat the auditorium area. When you realize that the average February snowfall in Squaw Valley is something like 11 feet you can see the importance of the snow melting system.

On the subject of snow melting, and also defrosting of the air source heat pump, it is of significance that both snow and frost rarely occur near winter design conditions but usually at higher temperatures. This means that the heat pump has more than enough capacity to handle snow melting systems and defrosting since its capacity increases rapidly with an increase in temperature.

Industrial Uses

The Squaw Valley installation demonstrates some of the things that can be done with a custom built heat pump — the industrial field opens even more varied application where the limits are set by the imagination of the designer. Of importance in the York custom built systems is the fact that standard York equipment has been used in each of the installations. This standardization facilities maintenance and procurement of replacement parts.

York has just introduced a major step forward in the heat pump field. This is the factory assembled central station heat pump. These heat pumps are available in 20 different units from 50 to 150 tons capacity. They are available with heating to cooling ratios from .9 to approximately .35 both in single stage and compound types. The units may be applied in multiple

for systems up to 450 tons and larger. They are all air source systems using water as the secondary refrigerant. The Model C28, for example nominal cooling capacity of 110 tons with a nominal heating capacity of one million Btu's per hour. It is designed to provide chilled water between 42 and 48°F. and hot water between 85 and 115°F. It is complete, as shipped from the factory, with its own control systems both electric and pneumatic. The control system is designed to provide fully automatic operation of the heat pump system to furnish constant water temperature during the cooling cycle and variable water temperature during the heating cycle. The hot water temperature varies inversely with the outdoor air temperature in order to provide maximum economy of operation. The controls will shift the operation of the system from single stage compression to compound compression at a point selected for maximum economy. The defrosting of the system also is automatic, taking place as required. Defrost of single systems is accomplished by hot water provided by the heat pump (water storage) while defrost of multiple systems is provided by York's patented thermo cycle defrost.

Factory Assembled

The HV units—the outdoor air units—are shipped separately from the factory so that all the field labor required for the installation of the factory assembled heat pump is to set the HV units and connect the piping between the compressor unit and the HV unit. The compressor unit is completely wired and insulated at the factory to permit easier field installation.

The benefits of the factory assembled system are many—to all concerned with the heat pump:

The User Benefits
- Reliability
- Smooth Operation
- Economies in operating cost and first cost

The Architect Benefits
- Minimum space
- Minimum structural requirements
- Complete freedom of location

The Engineer Benefits
- Drawing details minimized
- Simple selection data
- Accurate operating cost information

The Contractor Benefits
- Simplified installation
- Minimum field labor requirement
- Trouble-free start-up and operation

Having looked briefly at heat pumps both from the standpoint of today's practical approach and from tomorrow's potential, I hope you can share the industry's belief in the bright future of the heat pump.

PHOTO PROCESSOR MAINTAINS TEMPERATURE WITH CHILLER

More than two years constant use has convinced B. M. Loden of Color-Graphic, Atlanta, Georgia that he has the answer to quality film processing. Color-Graphic uses water chilled by a Heat-X PCS chiller and mixes with city water. A spread of 69½° to 70½° is maintained. Both large and small film processors are using the versatile chiller.

Refrigeration Research Foundation Announces Second Seminar

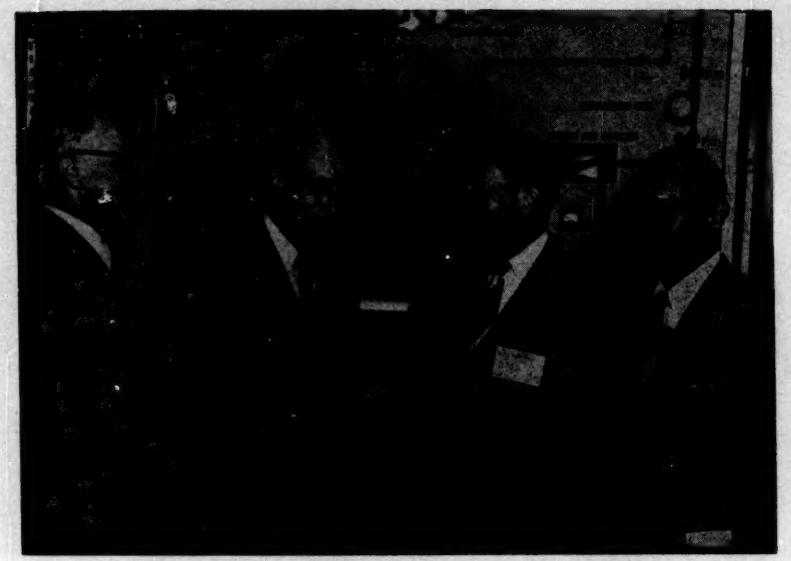
»» TO DATE, public refrigerated warehouses are the only segment of the frozen food business offering an industry-wide educational program on "Good Handling Practices for Frozen Foods". The program is designed to present to warehouse operating personnel the latest scientific and practical information on how to protect frozen foods from temperature damage.

The Refrigeration Research Foundation of Colorado Springs, Colorado, directs and, through its Scientific Advisory Council, presents this educational program. The first of these Seminars was held in San Francisco, California on September 22 and 23, 1959. Fifty-four representatives of nineteen public refrigerated warehouses on the West Coast were in attendance. The next Seminar will be held in Chicago on January 28 and 29, 1960, with a third one in the New York City area early in February.

The Refrigeration Research Foundation is a non-profit organization engaged in initiating and sponsoring scientific research at educational institutions and other food research installations.

The Foundation's research activities are supported by many public refrigerated warehouses along with other segments of the food industry.

For The Refrigeration and Record



Officials of the Air-Conditioning and Refrigeration Institute at the 11th Exposition sponsored by the ARI in Atlantic City, N. J. Left to right are: George S. Jones, Jr., Washington, D.C., managing director of ARI and author of this article; R. H. Luscombe, marketing manager, Penn Controls, Inc., Goshen, Ind., general chairman of the Exposition; Rudy Berg, president of ARI and vice-president, Copeland Refrigeration Corp., Sidney, Ohio, and George E. Mills, show director, Washington, D.C.

BY GEO. S. JONES, JR., Managing Director
Air-Conditioning and Refrigeration Institute

»» THE air-conditioning and refrigeration industry has had the best year in its relatively short history in 1959, and 1960 promises to break all records for the sale of all types and sizes of equipment using the "mechanical refrigeration" cycle.

At the 11th Exposition of the Industry, held at Atlantic City, N. J., in November, the almost-200 exhibitors were virtually unanimous in expressing the belief that the comeback made by the industry in 1959, after two years when the sales curve was considerably flatter than in the preceding decade, presages a record-breaking 1960 and continued progress through the "60's".

While all the figures for 1959 are not yet reported and tabulated, the growth trend already shown is enough to convince industry observers that 1959 sales of all products in our field will run as much as 20 per cent ahead of 1958, and 10 to 15 per cent ahead of the best previous year—1956.

Manufacturers' shipments of compressors, the heart of any mechanical refrigeration or air-conditioning system, and thus always a good indicator of industry activity, were running about 40 per cent ahead of 1958 for the first three quarters of the year. However, we are not forecasting that sales of all end products will reflect the gain to this degree, since manufacturers order these components months ahead of actual production and sale of consumer goods.

At the same time, sales of unitary air-conditioners probably will show almost this large a gain over 1958, based on figures for the first nine months of the year, and a total shipment figure of 320,000 units is being estimated, compared with 231,000 in 1958. "Unitary" equipment includes all central residential installations, and many smaller commercial and industrial ("packaged") applications. Central residential installations have, over the years, accounted for more than 60 per cent of unitary sales, so, following out the trend, the Institute estimates that some 200,000 U. S. homes have been centrally air-conditioned this year. This is more than double the home installations in 1954, five short years ago.

Interestingly, gains made by the heat pump are even greater than those indicated for unitary cooling equipment overall. Preliminary figures show that almost 40,000 unitary heat pumps will be shipped by manufacturers in 1959, compared with about 25,000 in 1958, and fewer than 2,000 in 1954.

Undoubtedly one of the factors behind the 1959 gains of unitary equipment has been the Unitary Certification Program launched by ARI at the beginning of the year to stabilize and standardize capacity ratings of this type of equipment and thus provide the purchaser with a yardstick in the purchase of home cooling. About 90 per cent of the manufacturers of unitary air-conditioners are participating in the program, which will be made known even more widely during the coming year as the Institute seeks to give assurance to purchasers and prospective purchasers on what these units will do.

Another has been the growing awareness of builders and the public of the truth of the declaration by Federal Housing Administration officials that non-air-conditioned homes in many sections of the country will be obsolete within 10 years, and the relaxing of FHA rules to encourage installation of air-conditioning in FHA-financed homes. Other federal government agencies have recognized the growing trend toward air-conditioning and its contribution to efficiency, and some of the Defense units are providing air-conditioned quarters for personnel who must be in top condition at all times for the defense of the country. (Incidentally, Air Force officials are giving consideration to the requirement that

Breaking Decade Ahead

any unitary equipment purchased by that service will, in the future, bear the seal of certification under the ARI program).

Aside from central residential air-conditioning, in which perhaps the most spectacular gains for 1959 will be shown when the final figures are in, the installation of big "systems" for the cooling of office buildings, apartments and hotels, industrial plants, and similar large structures has continued its upward trend in 1959, although perhaps not so sharply as in the smaller units.

Early estimates are that installed value of such systems in 1959 will be more than $600 million, a gain of about 10 per cent from the figure of $550 million in 1958, and almost 60 per cent over the five-years-ago (1954) installed value of $379 million. These figures represent "equipment in place", rather than the value of manufacturers' shipments, and include cost of installations, ductwork, grilles, and other elements that go to make up the system. Since components for these systems may be shipped from a number of sources, and some of the elements may not be specifically tagged for the type of installation for which finally intended, it is virtually impossible to arrive at a figure for shipments the elements themselves, in terms of units, hence the practice of using the "installed value" figure.

Manufacturers of system components feel that the potential for this type of equipment is great, particularly in the industrial field, pointing out that only about 10 to 15 per cent of U. S. factories are air-conditioned, but that industrial management is coming to recognize more acutely each year the economic benefits of industrial air-conditioning through improved employee health and morale, lower rates of absenteeism, increased efficiency and greater production. Hence, the outlook for continued gains in this field supports the overall optimistic forecast for 1960 and succeeding years.

Of no small importance in the consideration of air-conditioning systems for large installations such as office buildings is the fact that the General Services Administration of the federal government published results of a study during 1959 which showed that efficiency of office workers under controlled conditions of temperature and humidity was at least 9 per cent greater in air-conditioned than in non-air-conditioned spaces.

Another area in which air-conditioning is gaining by leaps and bounds is the automobile-cooling field. Statistics are not available, but it is known that all major motor manufacturers have stepped up the percentage of their automobiles which are leaving the factory completely air-conditioned (even in the lower-priced models), and the production of units for field installation has shown a similar growth which may be expected to continue and become greater in degree as more and more cars are air-conditioned.

The Society of Automotive Engineers has estimated that by 1962 one in nine cars will be air-conditioned, and 25 per cent of all cars produced within five years will be factory-equipped with air-conditioning.

Refrigeration Picture Good

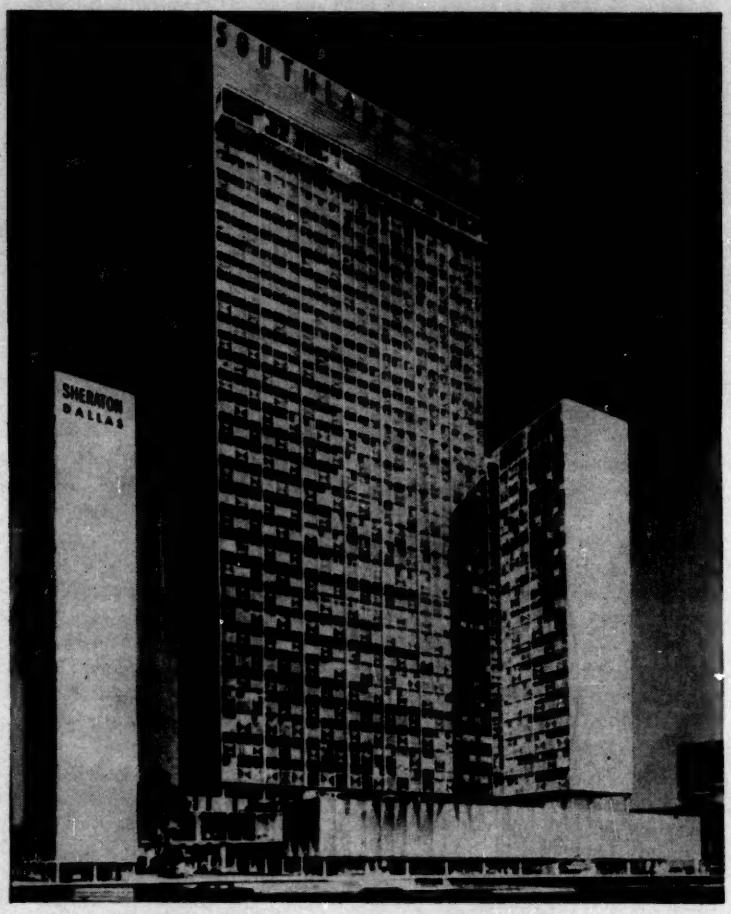
In the field of commercial and industrial refrigeration, the longer-established phase of mechanical cooling, 1959 has been an excellent year for most of the many products covered in this broad category, and forecasts of increased marketing facilities for foods (75 per cent of which are mechanically cooled at some point along the pipeline from producer and processor to consumer), as well as building outlook and developments in scientific and defense applications, auger well for a further step-up in utilization of refrigerating equipment.

Typical of the forecasts that lead manufacturers of refrigeration equipment to look to the future with optimism is the outlook for the frozen food industry, as expressed by Harold J. Humphrey, president of the National Association of Frozen Food Packers, in a talk at the Atlantic City meeting of ARI. Citing the growth of frozen foods as a factor in American life, Mr. Humphrey predicted that "in the next three to four years, total frozen food production should be between 8.5 and 9 billion (b) pounds, an increase of 1.5 to 2 billion pounds" over production this year . . . "I think you can see the pressing need for adequate refrigeration." This new equipment will be needed, he pointed out, 'particularly for trucks, backroom storage in retail stores, retail cabinets, and, of course, home refrigeration."

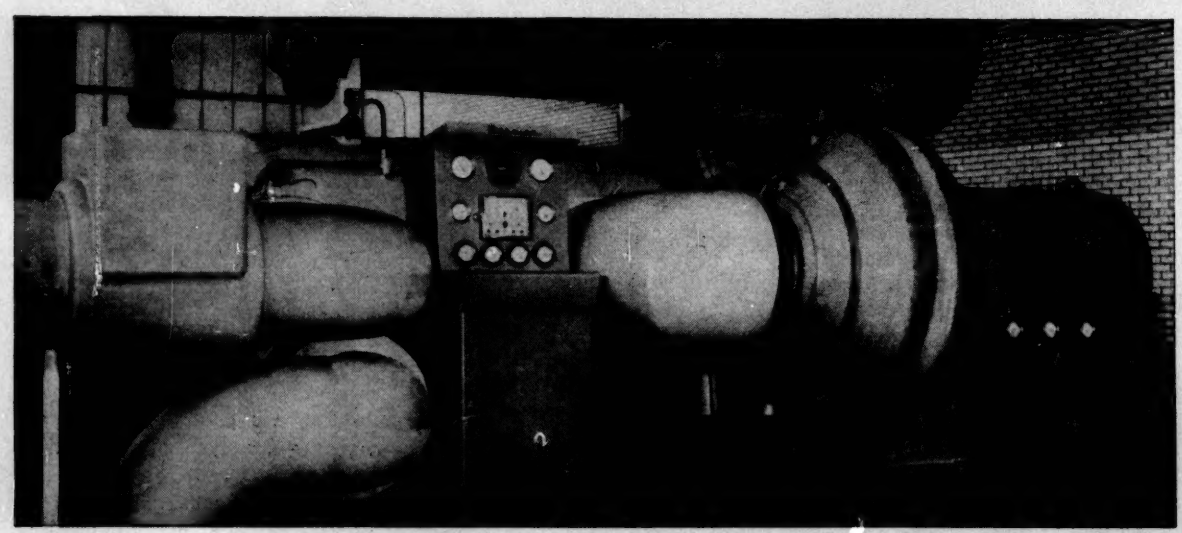
Military uses for specialized cooling equipment have shown a great growth over the past four or five years, and as highly-developed electronic processes, weapons systems, test facilities, supersonic aircraft, and nuclear-propelled water craft become an ever greater part of the nation's defense equipment, the essentiality of mechanical refrigeration to their production and operation will become more apparent—and vital.

This is only a brief summary of the many factors behind our industry's belief that "the 60's", beginning next year, will bring a continued growth in demand for its products. Our manufacturers will do their best not only to keep up with the demand, but will continue to develop and improve the equipment that contributes so greatly to our nation's health, happiness, productivity and defense.

Southwest's Largest Commercial



Architect's drawing of the block-square Southland Center in downtown Dallas. The 3-building complex includes the 42-story home office of Southland Life Insurance Company, the 600-room Sheraton-Dallas Hotel, a shopping area, a 2000-car garage and a 36-story skyscraper to be built at a future date.



A hermetic centrifugal water chilling machine, typical of those built by Carrier Corporation for Southland Center. Southland's air-conditioning system is the world's fifth largest in total capacity for commercial multi-room structures and the biggest yet using this type of equipment.

Air-Conditioning System is Charged with genetron® SUPER-DRY REFRIGERANT

Over 28,000 Pounds of "Genetron" 11 Used For Vast Air-Conditioning Project

Four stories underground—beneath the fabulous new $35 million Southland Center in Dallas, Texas—six 1000-ton centrifugal water chilling machines, built by Carrier Corporation, form the "heart" of the largest air-conditioning system of any commercial building in the entire Southwest. This giant cooling plant supplies enough cold water to cool and dehumidify air in all offices, rooms, shops, even lobbies and public passageways.

The refrigerant used in these special Carrier-built cooling machines is General Chemical's "Genetron" 11—shipped by special tank truck from our Baton Rouge Works in Louisiana. Actual unloading of the refrigerant was accomplished by pipeline from the sidewalk directly to the six units located four floors below in the engine room of the Southland structures. It is believed to be the first time this method of charging refrigeration equipment was ever attempted, and its successful outcome was the result of teamwork between General Chemical's sales and technical service staffs and representatives of Carrier.

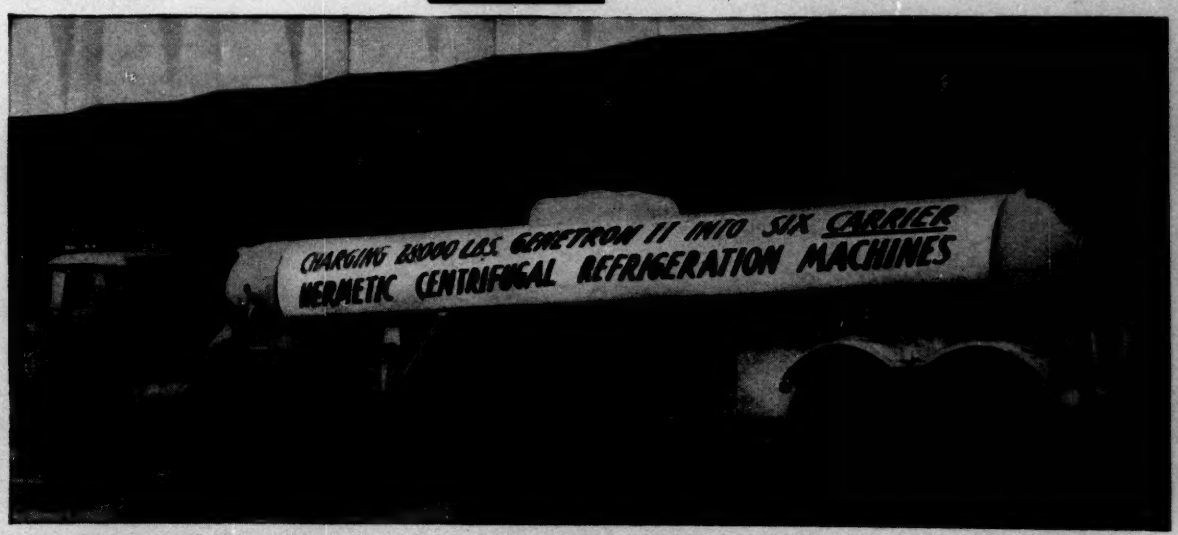
Service like this is typical of the close cooperation and support General Chemical is geared to give its customers... and the kind of service always available to *you* whenever you need it.

Service is *one* of the reasons why so many users prefer "Genetron" fluorinated refrigerants. Another is their uniformly high quality. Their moisture content is extremely low and their strict specifications are consistently *bettered* in production. Good reasons for *you* to insist on "Genetron"!

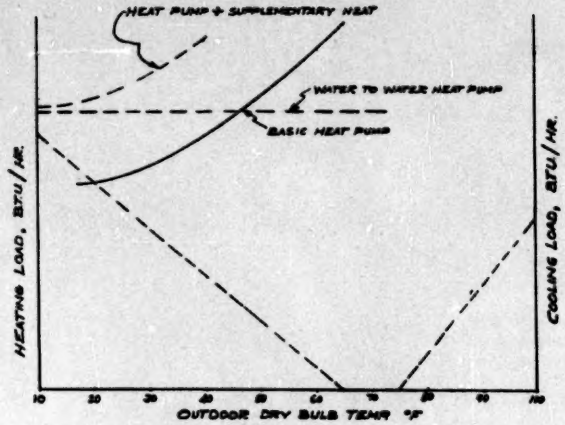
genetron 11 ORANGE LABEL CCl_3F TRICHLOROMONOFLUOROMETHANE
genetron 12 WHITE LABEL CCl_2F_2 DICHLORODIFLUOROMETHANE
genetron 22 GREEN LABEL $CHClF_2$ MONOCHLORODIFLUOROMETHANE
genetron 113 PURPLE LABEL $C_2Cl_3F_3$ TRICHLOROTRIFLUOROETHANE
genetron 114a BLUE LABEL $C_2Cl_2F_4$ DICHLOROTETRAFLUOROETHANE

Allied Chemical

GENERAL CHEMICAL DIVISION
40 Rector Street, New York 6, N.Y.



This special tank truck was used to ship "Genetron" 11 to the Southland project from General Chemical's Baton Rouge Works in Louisiana. 28,000 pounds of "Genetron" 11 were used to charge six 1000-ton Carrier hermetic centrifugal water chilling machines.


HEAT PUMP + SUPPLEMENTARY HEAT
WATER TO WATER HEAT PUMP
BASIC HEAT PUMP
HEATING LOAD, BTU/HR.
COOLING LOAD, BTU/HR.
OUTDOOR DRY BULB TEMP °F
FIG. 1

Heat Pump Application

By the Air Force

By J. R. Taylor
Mechanical Engineer
Headquarters SAC

»» THE usual pattern of operational and maintenance difficulties common to any electrical–mechanical system has followed the heat pump from the laboratory, through the various field test programs, and now into normal operational service.

I don't believe the problems are abnormal either in scope or in numbers; however, they do exist and they exert a profound influence on the operating cost and service rendered by this new type year-round conditioning system.

Experience to-date indicates that heat pump problems over which we the consumer have control generally result from errors in either:

a. Engineering application or;

b. Field application.

In the discussion which follows Heat Pump systems used by the Air Force are described and significant performance characteristics pointed out.

Engineering application criteria are listed, and Field application practices which effect operation and maintenance costs are illustrated.

Generally speaking each facility we encounter where both heating and cooling are required is a potential candidate for a heat pump application.

There are I believe some pretty good reasons for this attitude which may be summed up as follows:

a. It provides both-heating and cooling in a single, clean, easily controlled system.

b. The various problems and hazards involved in the direct application of some of combustible fuel are eliminated.

c. The overall cost of heating and cooling a facility is, (and must be) competitive with other types of systems and fuels.

NOTE: Devine "overall cost" is defined as the sum of all cost factors involved. (investment plus operation)

Various types of heat pump systems are available to industry where both size and environment are quite variable. In the Air Force we do not enjoy so much latitude, and accordingly our choice is limited. To date SAC has confined its heat pump installations to units no larger than approximately 10 tons (cooling capacity), and only one type of system has been used extensively. This is the single stage air to air (hermetic type unit) system comprised entirely of unitary equipment.

Approximately 3,900 of these single stage air to air systems have been installed and another 1,400 or thereabouts have been contracted for or are incorporated in plans for bidding. Approximately ninety eight (98)% of the units are less than 5 tons cooling capacity and have been installed in Capehart–Rains housing.

This type of heat pump system is an attractive choice in many ways. It may be completely factory assembled and installed as an "integral" or "package" unit, or factory assembled. Indoor and outdoor components may be installed independently and the necessary refrigerant liquid and suction lines connecting the units, assembled in the field.

This latter configuration is somewhat more expensive because of the field work involved in installation, drying, and charging the system. However, it is also much more flexible and has been used in a majority of the SAC installations.

Some orientation of the performance characteristics of the single stage air to air heat pump system may be in order. If we use the familiar C.O.P. *(Coefficient of Performance) Criteria for rating the effectiveness or efficiency of heat pump systems during the heating cycle we find they vary from 4.0 or 4.5 for heat pump systems in the most favorable environment down to approximately 1.5 for single stage air to air systems operating in outdoor air at ambient temperatures near 0°F. The high C.O.P. of 4.0 to 4.5 is entirely feasible with warm water sources such as wells, generator cooling water at a hydro plant etc. Such a system will also maintain near constant output with varying outdoor air temperatures and heating load so long as water temperatures of the heat source and heat rejection temperatures do not vary. This is a near ideal system from most standpoints. Operating costs are low, equipment size per unit of output

*Coefficient of Performance as used here is defined as the total heat transmitted or moved into the heated space divided by the heat equivalent of power required to drive the condensing equipment, compressor motor, fan and pump motors where applicable.

is low and the performance characteristics are virtually identical to that of a conventional heating plant utilizing combustible fuels. There are many ramifications of the heat pump system and each has its own characteristic performance capabilities which are dependent for the most part upon temperature spread trends between source and space and heat transfer characteristics of the various fluids involved.

The single stage air to air heat pump system has performance characteristics which are peculiar to this system as indicated. They are shown here on Figure 1.

You will note I have superimposed a characteristic water to water heat pump performance curved on this figure.

On first inspection the air to air heat pump system may appear to be a rather questionable choice for many applications; however, it has a number of redeeming features.

a. The system is universally applicable within the proper weather zones, and environment.

b. Unitary equipment is commercially available for all elements of the system up to approximately 10 tons capacity (cooling).

c. Little or no maintenance is required for heat transfer surfaces.

d. Field installation is simple and cheap by comparison with almost any other type heat pump system available today.

In terms of operating cost this heat pump system is competitive with combustible fuels in many areas. In other areas it is not, and a complete economic study is necessary to determine if it is a proper engineering choice.

If we assume the air to air heat pump system will operate at a weighted average or effective C. O.P. of two (2) and base power is available at one cent/KW hour, heat is purchased at a rate of approximately 7,000 Btu/¢.

This is not cheap heat; however, it is comparable with 14¢ oil if we assume overall utilization factor of approximately 70%.

The Engineering application of an air to air heat pump system involves consideration of the following criteria:

a. The heating design temperature—generally should not be less than 10°F for a normal installation.

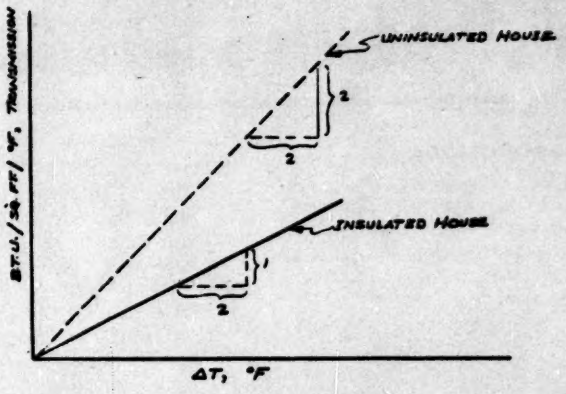


FIG. 2

b. The peak cooling load should not exceed 120,000 Btu per heat pump as determined by maximum size of unitary equipment available.

c. The maximum heating load cooling load ratio generally should not exceed 1.5.

Ordinarily hermetic type heat pump units should not be programmed for operation in ambient air at temperatures below 0°F. NOTE: Generally unit will not operate successfully at this condition —motor doesn't cool because of low mass flow of refrigeration and high value of work per pound on refrigeration gas.

d. Generally heat pumps should not be applied in dwellings where the transmission slope is less than approximately .50. Figure 2 indicates comparison of acceptable and unacceptable transmission rates. Curve with .50 slope is for completely insulated modern house.

e. Special consideration must be given the control problem for multizone application. Continuity of airflow rate through the indoor (condenser) unit is necessary if the unit is to stay on the line at high outdoor ambient temperatures.

f. Calculations indicate peak electrical demand for a heat pump (with supplemental electrical heaters) is approximately double that for an air conditioner in the same facility. This is determined on the basis that the heat pump proper will carry 60% of the peak heating load with the remainder being carried by supplemental heating. NOTE: On this same topic diversity factors are not considered applicable for either air conditioning or heat pump equipment. When its cold—or hot its cold or hot for every facility in the area. Failure to recognize this fact has been expensive on several occasions.

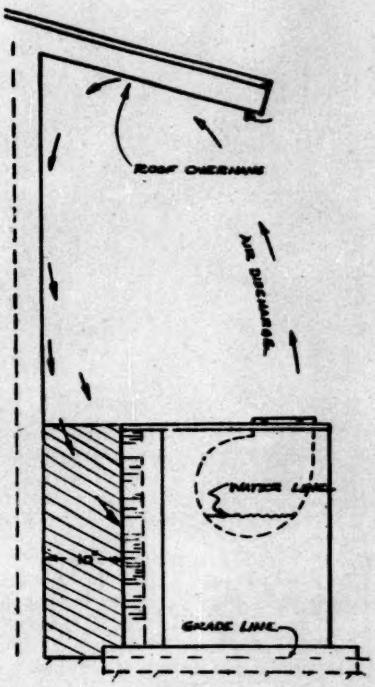


FIG. 3

g. On a first cost basis the heat pump is a "toss up" with the air conditioner and gas furnace. When the air conditioner and oil fired furnace are compared with the heat pump, the heat pump costs less.

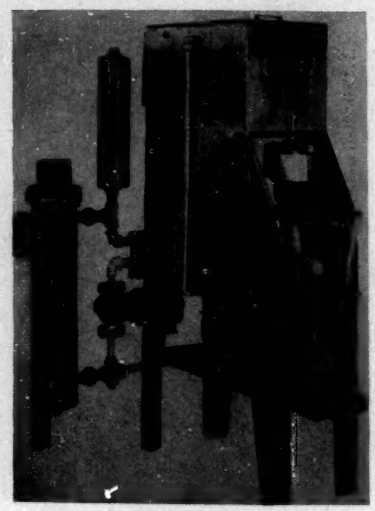
h. One more item on engineering which may be of interest. Where supplementary heat (electrical) is required it would appear

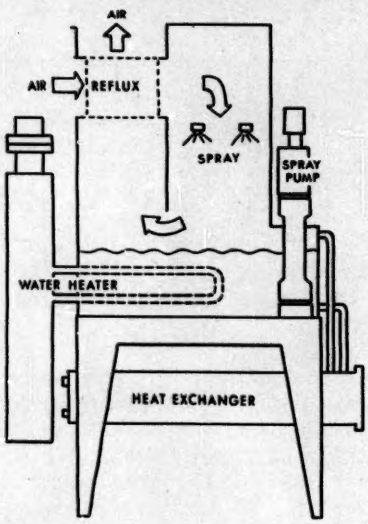
Continued on page 31

New Products Designed to Improve Operation

New Concentrator

ADAPTING a submerged electric water heater, the Niagara Blower Co. has introduced a new concentrator for restoring *No Frost* to its proper





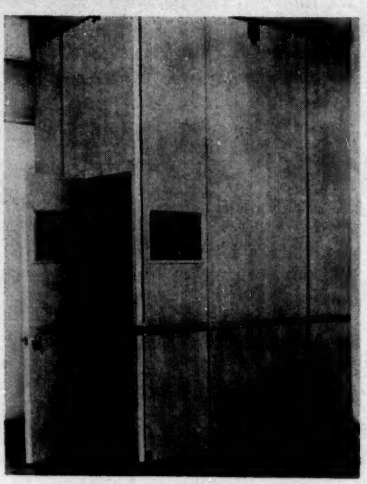
strength after it has been used to remove moisture from refrigerated coils. The water heater provides sufficient heat to evaporate water picked up by the hygroscopic liquid. The reconcentrated liquid is returned to its frost prevention duty. Operating at a low temperature of 140 F maximum, the equipment avoids all fire hazards, is easy to keep clean and greatly reduces the chance of operational failure. Four sizes are available.

Noise Reduction Panels

A NEW architectural panel has been placed on the market by the Acoustical Division of Elof Hansson, Inc., New York. The panel has excellent sound absorption qualities, comparable to a high quality acoustical tile material. In addition, it prevents sound transmission to a degree equal to a high grade dry wall partition.

The E H Deluxe Noise Reduction Panel has a light color veneer type finish with scuff resistant lacquer coating. One side of the panel is perforated and the other side is unperforated. Thickness of the panel is 2⅜" and the standard size 4' x 8'. It can be cut with conventional carpenter tools and installed by using either wood studs with wood moldings or a simple steel partition system supplied by Elof Hansson.

The panel is ideal for separation of and reduction of noise in offices, factories, schools, recording studios,



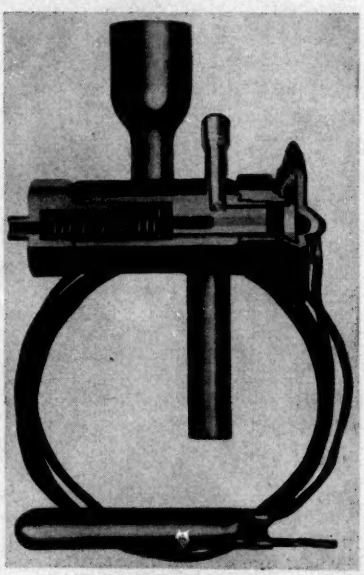
etc. Under usual conditions, the installed panel will cost as little as the lowest cost movable dry wall partition.

New Design Thermostatic Expansion Valve

OVER one million life cycles on standard refrigeration and air conditioning applications and over 100,000 life cycles of extreme pressure fluctuations incurred during heat pump reversals are withstood by the new Model 214 "flat-top" thermostatic expansion valve now available from the Heating and Air Conditioning Controls Division, Controls Company of America, Milwaukee, Wisconsin.

The valve is designed primarily to meet the severe demands of high-pressure heat pump applications. According to Controls Company engineers, conventional refrigeration valves often malfunction after about 7,000 life cycles, making them unsatisfactory in withstanding the shock of extreme reverse-pressure differences across the diaphragm encountered in heat pumps.

Amplifying on this problem, Controls Company engineers point out that when a heat pump system calls for heat or cooling opposite to the way it was last operating, the inlet and outlet sides of both valves are immediately reversed. This sudden withdrawal of high pressure on the outlet side, coupled with high thermal bulb pressure puts heavy strain on



the diaphragm, often resulting in malfunctioning after about 7,000 life cycles.

The Model 214 "flat-top" valve is designed to meet reverse cycle pressure reaching 450 psig found in heat pump systems. Controlling the nomi-

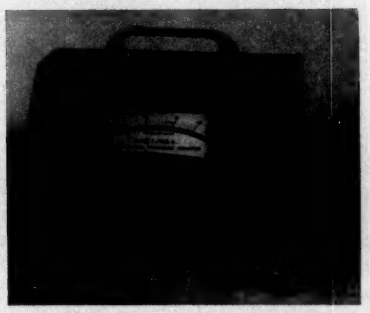
nal pressure of 50 to 70 psig found in standard refrigeration systems is thus accomplished with a wide margin.

The unit derives the "flat-top" name from its unique head design that controls the diaphragm flexing. During the refrigeration cycle, the diaphragm is supported by a minimum arc head piece, eliminating bending and metal fatigue. The head is of Heli-arc welded construction, corrosion-resistant stainless steel to provide high tensile strength.

The valve is available for use with both Refrigerant 12 or 22 with either standard liquid-charged or pressure-limiting charged power elements. Capacities for Refrigerant 12 are 1, 2 and 3 tons; with Refrigerant-22, 2, 3 and 5 tons. Solder-type inlet, outlet and external equalizer connections are featured. Inlets are standard in 3/8, 1/2 and 5/8-inch O.D. solder; outlets are 5/8, 7/8 and 1-1/8-inch O.D. solder; external equalizer is 1/4-inch O.D. solder.

Differential Pressure Gauge

HASTINGS-RAYDIST, Inc. of Hampton, Virginia, announces the introduction of a new series of electrical instruments for accurate determination of differential pressure of air and other gases. The most sensitive of this new series of instruments has a full scale range from zero to .01" H_2O and detects pressure differences as small as 0.0001" H_2O. Other models have a full scale range from zero to .03", .1", 1.0", 3", 10", 20", 50" and 100" H_2O.

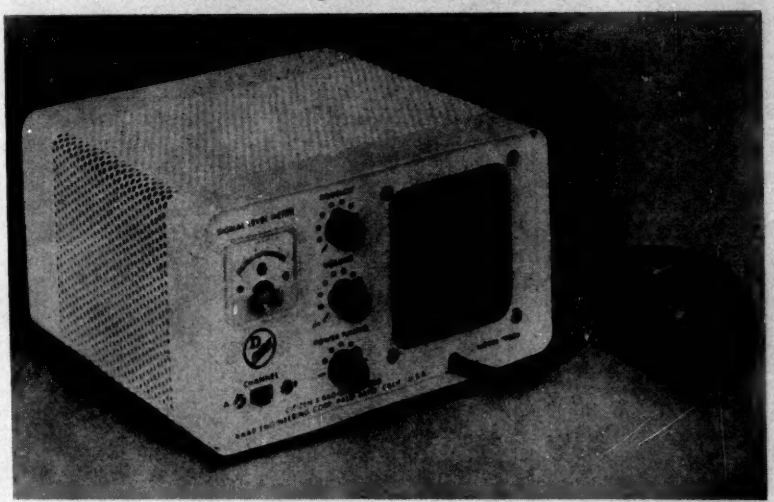


These Hastings Differential Pressure Indicators are electrically operated on 115 volt 60 cycle a-c, and the sensing device is a noble metal thermopile installed in a flow tube. These flow tubes can be installed directly in a line for use as draft gauges or for controlling differential pressure in industrial and commercial heating systems, or they can be installed so as to measure pressure differential across an orifice in an air or gas line, thus becoming the equivalent of a remote electrical flowmeter. Sensitivity is increased in the lower part of the range, thus more nearly linearizing the scale when calibrated in terms of flow. Since these instruments also compensate for changes in pressure and temperature of the air or gas, they can be calibrated directly in terms of mass flow if desired. They are also suitable for use with remote recorders.

The indicating instrument and the flow tube utilize the Hastings patented heated thermopile principle, employed in all Hastings vacuum, pressure, velocity and flow measuring instruments. The noble metal thermopile is chemically inert, is not affected by oxidation, and operates at a low temperature, which prevents surface reaction and evaporation of the themocouple matertials that might otherwise interfere with the accuracy and useful life. The thermopile is extraordinarily resistant to mechanical shock and vibration, as the thermocouples are butt-welded wires of short span and have very low inertia.

This series of instruments has been especially designed for those applications where the user needs to accurately determine pressure difference in a specific range for production testing, quality control and product design.

Radiotelephone For Industry



A NEW economical means of communication is now available to the construction and manufacturing industry of a "Citizens-Band" mobile radiotelephone at $179.00 by the Kaar Engineering Corp., Palo Alto, California.

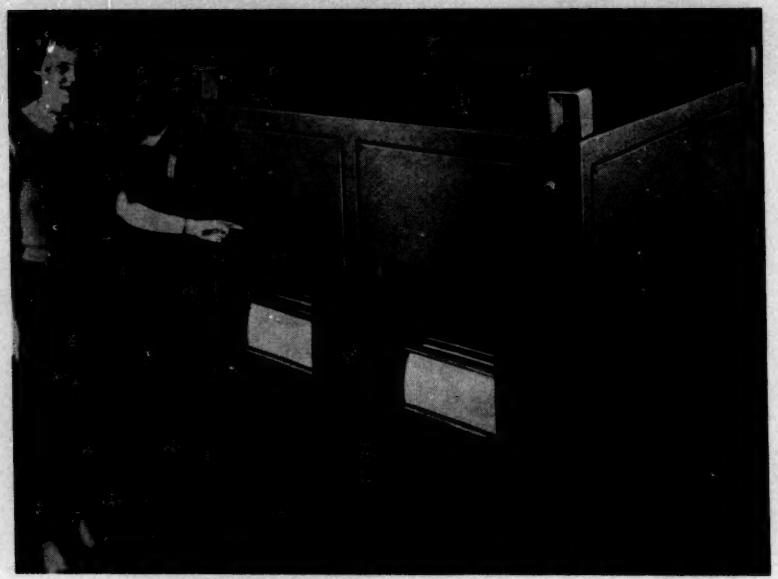
This new radiotelephone, called the "D" PHONE, is designed specifically for economical, short range communications in the industrial, business, building and contracting, transportation, marine, farming, medical, services, sporting and recreational fields. Actually the number of applications are unlimited because any citizen over the age of 1 can be licensed to use this Class "D" radiotelephone simply by filling out an FCC form without any prior radio experience or knowledge.

The Kaar "D" PHONE is a 5 watt mobile unit designed for operation on any two of the 23 available channels in the 26.96–27.33 Mc frequency band. It is available for either 12 volt DC or 117 volt AC operation with a 6 volt DC model to follow soon. With average operating conditions the effective range is usually between 5 and 10 miles. However, much greater ranges are often possible over large bodies of water.

This new radiotelephone is a dual channel unit with crystals on both transmit and receive. A Signal Level Meter and power output peaking controls are featured. It also has a super-heterodyne circuit with automatic noise limiting and automatic volume control. There is a channel switch for selecting either one of the channels. Exterior design of the unit is extremely functional with a unique mounting hood available for easy under-dash, under-desk or desk-top installation. The "D" Phone is finished in attractive contemporary black and off-white colors to blend with other equipment and today's modern decor. The unit is very compact and and weighs only ten pounds.

The Kaar "D" Phone comes complete with push-to talk mike, one set of crystals, a complete summary of instructions, FCC rules for licensing and operation and the forms required for submission to the FCC.

Halstead & Mitchell Enters The Air Handler Field



HALSTEAD & Mitchell is now manufacturing and selling a complete line of air handlers for centralized conditioning service. The company offers 16 models, with many variations. Capacities range from 880 to 47,500 cfm. Coil face velocities extend from 400 to 700 fpm. These air quantities are obtainable even under static loads up to 2-inch w.g.

The Halstead & Mitchell air handling units can be used with direct expansion coils (capacities range from 3 to 120 nominal tons under standard conditions), chilled water or hot water coils, or steam coils. Face areas range from 2 square feet to 68 square feet. Discharge direction may be horizontal or vertical. Either high or low velocity filters may be cleanable or throw-away designs. As an optional feature, vibration isolaters for ceiling hung units may be specified. Insulation is fire-proof, vermin-proof and water-proof.

Permanently-sealed ball bearings require no lubrication or servicing. Orders may specify variable pitch sheaves, to lend flexibility in air delivery, and centrifugal blowers of the forward curved blade type, balanced and mounted for quiet operation.

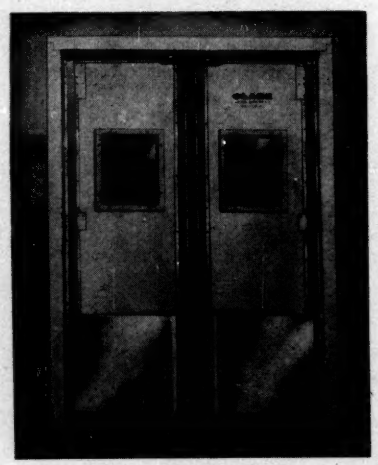
A choice of fins in aluminum or copper is available. They feature Halstead & Mitchell's exclusive Turbu-Flo design, to assure heat transfer gains of up to 15 per cent. Seamless copper tubing is manufactured in Halstead & Mitchell's own complete copper mill.

Complete information and prices may be obtained by writing to Halstead & Mitchell, Bessemer Building, Pittsburgh 22, Pennsylvania.

Shock Absorber Door

URETHANE-FILLED bumper takes the shock at the door in a new autoclose model introduced by the Clark Door Co. According to the manufacturer, this new concept permits the leaves of this type of access to withstand continual pounding by damage or costly repairs.

Trucks never touch the door proper, and flexible hinges running lengthwise provide uniform distribution of stress at sides. An unconditionally guaranteed spring return assures tight accurate closures. Neoprene seals are employed at the door's periphery. The new shock absorber door will fit standard openings and comes complete and easy to install.



New Submaster Regulator

A NEW submaster regulator has been developed for accurate control of remotely readjusted temperatures in heating, air conditioning, and industrial processes.

Called the Series 200 Submaster Regulator, it is made by The Powers Regulator Company of Skokie, Illinois.

The device is a pneumatically operated temperature controller, whose control point is reset by a master controller or positioning switch.

The master may be a thermostat hygrostat, pressure regulator, or a manual positioning switch. The submaster has a throttling range adjustment of 0 to 35 percent. The gas-filled thermal system is unaffected by cross ambient bulb and capillary temperatures. It also eliminates the need for bulb elevation correction.

It is provided with direct action and reverse adjustment. Action and adjustment can be readily converted.

Typical applications are:

Fan Discharge Control: The submaster positions a powerstroke motor to regulate duct air temperature in response to a pneumatic signal from a three-point averaging relay. The relay averages signals from an outdoor thermostat, a room thermostat, and a positioning switch to reset duct temperature in accordance with demand.

Remote Process Control: Submaster, reset by a positioning switch, controls the temperature of a liquid flowing through a pipe. The positioning switch and gauge can be mounted on a central control panel at a distance from the process.

Hot Water Zone Supply: The zone supply hot water temperature is controlled by a master outdoor thermostat, which resets the Submaster. The Submaster controls a water mix valve to maintain the desired supply of

water temperature. As master thermostat temperature increases, the set point of submaster decreases, resulting in lower water supply temperature.

Dewpoint Control: Submaster, with bulb located on discharge side of the air washer, is reset by a direct acting room hygrostat. The submaster positions a water mix valve, blending chilled and return water to maintain dewpoint temperature. As relative humidity rises, the dewpoint temperature is lowered.

Additional information is available in Form P-73 from Dept. RCC, The Powers Regulator Company, 3434 Oakton Street, Skokie, Illinois, or from The Powers Regulator Company of Canada, Ltd., 15 Torbarrie Road, Downsview P. O., Toronto, Ontario.

Dielectric Coolant Pump

A NEW high efficiency, lightweight pump designed for liquid cooling of electronic instrumentation and able to pump any dielectric fluid has been marketed by Task Corporation, Anaheim, California.

According to the manufacturer, the new dielectric coolant pump is designed to minimize cavitation problems encountered with low inlet suction pressures associated with high altitude operation. Unique wet motor construction obviates use of rotating seals and attendant leakage problems.

Other applications include use as a fuel transfer or booster fuel pump and the unit can be manufactured to meet applicable military specifications.

Specifications include: continuous duty 4 pole, 3 phase, 200 volt motor; weight, 21 ounces; amps, 0.75; pump pressure rise, 20 PSI at 2.8 GPM. The pump is 4.38 inches long and has a diameter of 2 inches. Bearings are carbon and the pump can run dry.

400 Cycle Motor Compressor

GREAT Lakes Manufacturing Corp., Cleveland, Ohio, has designed and is manufacturing a new series of hermetically sealed compressors for use in electronic equipment cooling systems in aircraft, missile and ground support systems. Outstanding design features include light weight, small size, and the ability to operate in any altitude due to an oil-mist lubrication system.

The compressors are powered by 3 phase 400 c.p.s. motors in either single or two-stage design. No oil sump as such is provided in the compressor. The refrigerant and oil mixture is predetermined on the basis of the system's requirement. Refrigerants 11, 12, 22 and 114 may be used depending on the application. All compressor sizes 1/6 through 6-1/2 hp are designed to meet Mil-E-5400 and Mil-M-7969A specs. The compressors may be operated in high ambient temperatures with life expectancies ranging up to 5,000 hours.

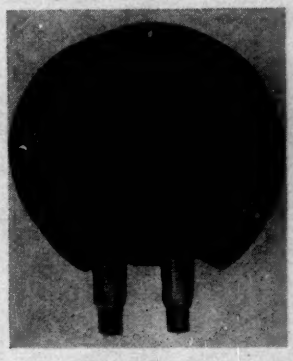
For further information contact Tom G. Crider, staff engineer for Great Lakes, 4223 Monticello Blvd., Cleveland, Ohio.

Pressure & Vacuum Gauges

WEKSLER Instruments Corporation, is making available a Regal Line of medium duty pressure and vacuum gauges featuring guaranteed accuracy of 1% of scale, bronze bushed rotary movement and adjustable pointer. These gauges are enclosed in black enameled aluminum cases with chrome plated, brass slip ring. They are available in phenol, iron or brass cases, also. A phosphor bronze bourdon is silver brazed to forged brass socket and stress relieved for fabrication.

Sizes: 3-1/2, 4-1/2, 6 and 8-1/2 inch dials.

Types: Pressure, vacuum compound—for steam, air, oil, gas water, etc., from 30 inches vacuum to 10,000 psi. Refrigerant combination pressure and temperature equivalents for Refrigerant 12 or 22.



Altitude—feet of water, for tanks, reservoirs, hot water heating systems.

Altitude—combination of feet of water and pressure scale.

Duplex—Two gauges in one case, two readings on one dial.

Self-Spraying Penetrating Oil

USING a special light oil formulated to free corroded parts fast, Sprayon No. 203 Penetrating Oil is packed in self-spraying aerosol cans

for pinpoint delivery and quick penetration. It is ideal for lubrication of tight-fitting parts and will not harm painted surfaces, according to Sprayon Products, Inc., Cleveland, Ohio.

A free handbook of Sprayon "Aerosols for Industry" is available from Industrial Supply Division, Sprayon Products, Inc., 2075 E. 65th St., Cleveland 3, Ohio.

Pipe Covering

AVAILABILITY of pipe covering made of *Unicrest* polystyrene was announced in early Fall by United Cork Co. Three standard thicknesses are produced in both regular or self-extinguishing types. They are classed

light duty, medium, and heavy duty for temperature ranges above freezing, below 32 F, and from zero to minus 30 F, respectively.

This new product has characteristics that approach the ideal. It effectively stops heat gain, and prevents condensation and dripping. In addition to the low K-factor, it has the desirable characteristics of being odorless and non-toxic, and resists moisture. With a compression strength of 16 to 20 lbs./sq. in., outside hangers can be used to support pipe runs without additional protection.

Jacketing For Pipes

PYRO-KURE, a vapor barrier with new fire retardent properties has been announced by American Sisalkraft Corp. for use as pipe jacketing and duct insulation facing. The product is composed of foil and kraft paper bonded together with a flame-extinguishing adhesive to make a completely fire-resistant vapor barrier. When the temperature surrounding this material reaches the combustion stage, gases or vapors are released which tend to smother the flame.

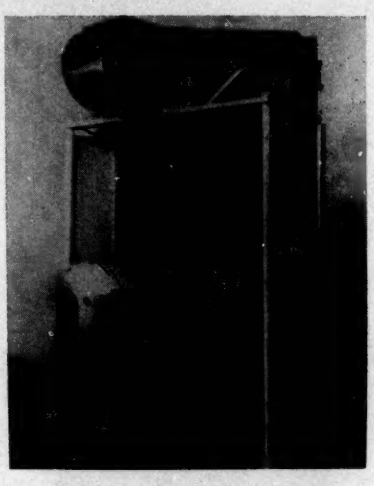
The new jacketing is also a multi-purpose barrier material that can be used for hot or cold piping. Water or weathering conditions have little or no effect on the flame-extinguishing properties and the adhesive will not melt or run. The reinforcing glass fibers give *Pyro-Kure* unusual strength to assure tear and puncture-free applications. The first installation of *Pyro-Kure* pipe jacketing is at the University of Missouri where some five miles have been installed on hot, chilled and service water, and steam pipes.

The National Bureau of Fire Underwriters rates this material as *non-combustible.*

Introducing Air Walls

COLD-ROOM doorways equipped with a newly developed *Air-wall* can remain open for heavy traffic without costly refrigeration loss. These *Air-walls* introduced by Lehigh Manufacturing Co. are designed for quick installation, in either old or new freezers, refrigerated terminals or warehouses, frozen food processing spaces, and other areas that would customarily require a refrigerator door. Models are available for 3-ft to 8-ft widths. According to the manufacturer, savings in power, equipment wear and servicing will very quickly cover the initial cost.

Installed directly over the cold-room door frame, *Air-Wall* begins operating the instant a door is opened. Cold air from the room is drawn into the unit by a fan, then forced downward at increased velocity blanketing the entire doorway with a fast-moving stream of cold air. This stream acts as a shield keeping warm air out,



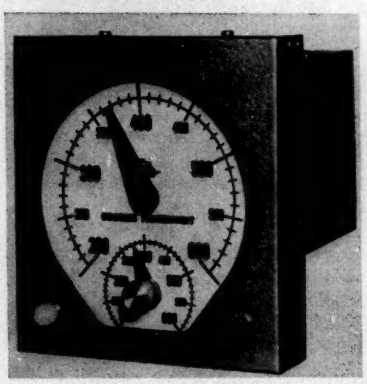
cold air in. *Inner doors can be eliminated to allow workers to move quickly and safely through the open passage.*

Indicating Temperature Controller

THE series 6000 Indicating Temperature Controller features a 12" circular readout based on a rugged stable null balance servo system. Temperature control is maintained electronically without depending on the meter movement for control. The temperature indication always presents a true readout of temperature of the process being controlled throughout the entire range of the instrument without limiting stops. The indicating pointer can be clearly seen by the operator at some distance.

The 6000 series instrument is available with either time proportioning or on-off control, with or without anticipating section. Control stability of the proportional model with anticipating section has been achieved to ±0.1°F., and to ±0.5°F. with the on-off model with anticipation. Indication accuracy is ±1% of scale range.

The 6000 series control is provid-



ed with plug-in plastic encapsulated circuitry. This rugged construction provides freedom from dust and moisture and insures continued operation under conditions of shock and vibration, which permits mounting of the controllers directly on machinery where these conditions exist.

QUESTION BOX

HAVE A QUESTION? Address it to Question Box Editor, Industrial Refrigeration, 433 N. Waller Ave., Chicago 44, Ill. Answers appear monthly in this department on problems forwarded by readers. Comments from all readers welcomed.

Selecting A Refrigerant To Meet Insurance Rates

QUESTION: In constructing a refrigerating plant within the metropolitan area, would it make any difference in the selection of the refrigerant for our cooling system with regard to: (a) our fire insurance rate? (b) our casualty insurance?
D.M., M-a-L

ANSWER: (a) It would make no difference insofar as a fire insurance rate is concerned if a frozen food packer, cold storage plant, brewery, or any other process industry used a refrigeration system with ammonia as the refrigerant, rather than one which used one of the halogenated refrigerants. The only time in this particular instance that there would be a charge made would be if the system used were of a flammable nature, such as methane, ethane, etc.

Another item that might enter into an extra charge for fire insurance purposes is if the insulation of the refrigerating room consisted of some other material than cork board.

(b) As regards casualty insurance, that is, Workmen's Compensation or Public Liability, it is a little harder to determine whether the rates might be higher if a toxic refrigerant were used. Premium rates on these particular types of insurance are based on experience figures pertaining to each particular risk and as a result the additional charge would probably not appear unless there were a claim emanating from the use of such refrigerants.—**J.W.M., Chicago.**

COMMENT: It is best that you consult with your local building inspector and/or fire marshall before you select the refrigerating plant. Many metropolitan areas have codes or regulatory ordinances which define the type of refrigerant which may be used according to building occupancy or other classification.

Those codes which are based on the AMERICAN STANDARDS SAFETY CODE FOR MECHANICAL REFRIGERATION, will group refrigerants into three classifications, called Group 1, Group 2 and Group 3. That code then defines maximum permissible quantities of refrigerants of the various groups for direct and indirect refrigeration systems.

Compliance with your local ordinance or state statute as appropriate, should receive consideration before the other two items of fire and casualty risk expense. As a matter of fact, compliance with your local regulations will probably bring you within the best premium available in your locality.—**Editor.**

Economic Defrosting of Pipe Coils

QUESTION: Reporting on the TRRF Scientific Advisory Council meeting last March, INDUSTRIAL REFRIGERATION reads on pages 42 and 43 in May 1959 "that defrosting is in order when the frost bridges over between adjacent pipes".

Further, "that appeared to be the economic break-off point although refrigeration efficiency fell off sharply at 3/4-in. frost formation".

Being practical men, the warehouse superintendent and myself have always defrosted when the air passage between pipes is cut-off by the frost. My boss, however, who attended the TRRF meeting has contended since then that we should defrost at 3/4-in thickness. However, that appears to be costly to us as it involves more labor in the warehouse to clean up, and more engineering personnel under my direction diverted from maintenance jobs to more frequent defrosting operations. What can the "Question Box" offer on this?
—E.R., Chicago.

ANSWER: You are referring to the sub-heading "Practical Defrosting" in which INDUSTRIAL REFRIGERATION'S correspondent summarized a preliminary report by Professor W. F. Stoecker at University of Illinois. Professor Stoecker was reviewing progress of a project jointly supported by ASHRAE and the TRRF on the subject "Investigation of Frost Formation on Refrigerated Coils".

Complete results of this investigation will be given by Professor Stoecker in February at the meeting of the American Society of Heating, Refrigeration and Air Conditioning Engineers at Dallas, Texas. It will be worth your while to obtain a copy of the issue of the ASHRAE JOURNAL in which the professor's report appears, or order reprints when they become available. In the meantime, the "Question Box" can give you the benefit of some additional remarks by Professor Stoecker which were published by The Refrigeration Research Foundation in April. (The charts accompanying this reply were a part of Stoecker's preliminary report.)

"This is a basic study on the effect of frost on heat transfer to the refrigeration coils. This was designed to provide the warehouseman with knowledge of when frost on the coils reduces the efficiency of his system.

First Effect: More Transfer

"When frost accumulates on pipe coils that are cooling air by natural convection, the first deposit of frost increases the coefficient of heat transfer. This increase is due to the roughening of the surface which gives a greater area for heat transfer in the same manner as the addition of fins. As the frost deposit thickens, the coefficient of heat transfer remains somewhat constant for two reasons: one is the increase in external surface area, and the other is the increase in conductivity of the frost as it becomes more dense due to aging.

"The coefficient of heat transfer begins to diminish when the thickness exceeds 0.5 to 0.6 inches, and drops off rapidly when the passages for air flow become blocked (See Fig. 1).

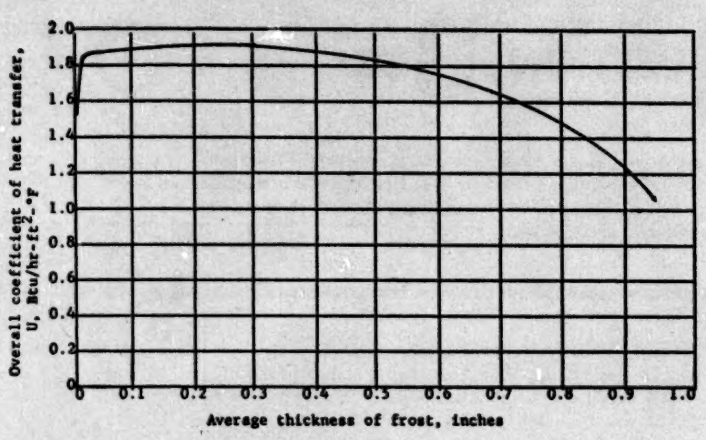


Fig. 1. Effect of Frost Thickness on the Overall Coefficient of Heat Transfer

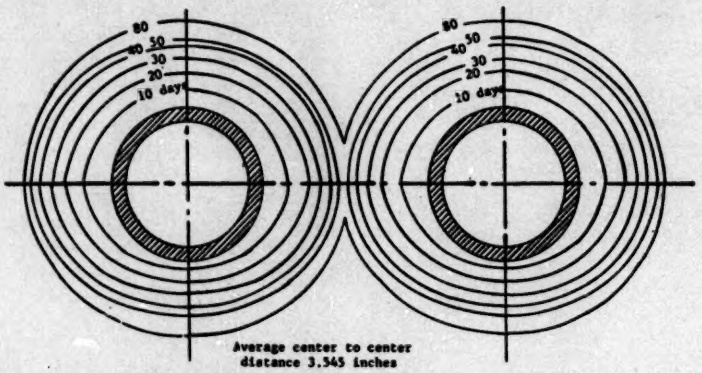


Fig. 2. Profile of Frost Deposit after Various Periods of Operation

"Frost does not form as a perfect circle about the pipe, and the character and grain size of the frost differs on the top, sides, and bottom of the pipe. Fig. 2 shows the average thickness of the frost on a pipe after various periods of operation.

"At least in the early stages of deposit, the frost is thickest on the sides, not quite as thick on the top, and fairly thin at the bottom. This variation may be explained from the velocity pattern of air when it flows by natural convection over a cylinder. The maximum velocity occurs at the sides and thus gives the maximum values of heat transfer there, as well as providing the maximum values of water vapor transfer which contributes to the thickness of frost."

Frost and Heat Absorption

Some years ago a similar question was asked and the late Professor H. G. Venemann replied as follows: "In the third edition of the NAPRE Lecture Course the unit conductivity of snow on refrigerating coils is given as 3.13 Btu/hr/°FTD. The density of this frost is a variable which depends among other things on the temperature of the piping and the age of the frost.

"For this reason it is not practical to consider anything but average conditions. Since the conductivity of iron or steel is more than 100 times that of the frost, the piping can be neglected in the calculations. The conductivities of various thicknesses of frost based on the above factor are therefore:

Frost thickness	1"	2"	3"	4"
Btu/°FTD	3.13	1.56	1.04	0.78

Stoecker and Venemann seem to be pretty well agreed that efficiency falls off in the neighborhood of 3/4 to 1-inch thickness. In older storages, especially where brine is the refrigerant, the piping was large and spaced such that it may have taken considerable time to bridge over with frost between parallel lines. Today, with direct expansion of NH₃, pipes are relatively smaller, as indicated in Fig. 2 and therefore, spaced much closer. By the time this piping arrangement bridges over, 3/4's-in. thickness of frost will have been exceeded.

Let's say that when frost bridges over between pipes, defrosting is mandatory; when it exceeds 3/4's of an inch it is probably approaching the most economical point at which to defrost. —J.R.K.

Pennsalt Publishes Brochure On Blowing Foams

››› BLOWING urethane foams with fluorinated hydrocarbons, a method which is growing in popularity because of the economy and uniformity of foams it produces, is presented in a new publication by Pennsalt Chemicals Corporation. Entitled "Blowing Foams with Isotron," the brochure discusses recent developments in foam making techniques.

Because Isotron is used as an integral part of the urethane formulation and produces the plastic's cellular structure as it vaporizes at its low boiling point (75°F.), its adoption in foam making eliminates the need for gas generating equipment. The Isotron foaming action throughout the structure of the urethane is steady and gradual in contrast to the irregular foaming of older and costlier methods. The foaming action can be controlled with Isotron, there is a more uniform pore size, and quality control problems are reduced considerably. Foams made with Isotron cure faster, and make faster production and automatic operation possible. Such foams are also stronger and have a better appearance.

In addition to discussing the above advantages, the Pennsalt brochure points out that Isotron-produced foams have lower heat conductivity, wide range of densities, greater moisture resistance, and better adhesion to retaining walls. The brochure also lists some of the growing uses for urethane foams. A chart comparing physical properties of the most widely used insulating and cushioning materials and technical data on Isotron is included. Copies of the brochure are available from Isotron Department, Pennsalt Chemicals Corp., 3 Penn Center, Philadelphia 2, Pa.

New Literature Gives Physical Property Of Cryogenic Fluids

››› A NEW folding pocket card presenting in tabular form the physical property equivalents of some cryogenic fluids is now available from Linde Company, Division of Union Carbide Corporation.

The card gives boiling and melting points; critical temperatures and pressures; volume, mass, and thermal equivalents; and conversion factors. The cryogenic fluids treated are those most useful to engineers in the chemical and missile industries.

Copies may be obtained by writing to: Distribution Department, Linde Company.

Heat Pump Application

Continued from page 23

advisable to limit use of supplemental heat with a temperature limit relay set to limit operation above 40°F D. D. or thereabouts.

In some ways the field application of heat pumps is more difficult than the engineering phase. There appears to be no limit to apparently harmless variables which suddenly become critical problems. I have selected a few examples here of field application problems which are typical:

a. In Figure 3, you see a sketch of an actual installation where we had a serious recirculation problem and some water problems.

b. Figure 4 illustrates the ice problem with heat pumps. This can be remedied by using a thick slab and cutting it off flush with the condensing coil. One manufacturer slopes the coil back into the unit. This also is a good configuration. The air space under the condenser unit may seem very insignificant. Actually it may be the difference in a 5 or 15 year life expectancy from the condenser base.

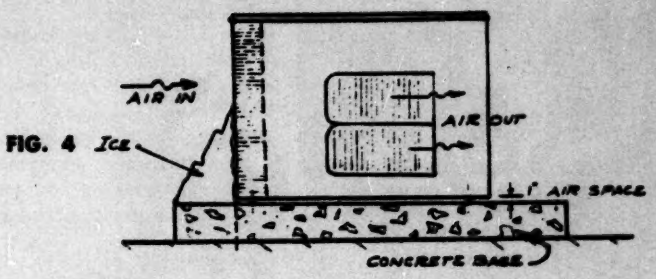


FIG. 4

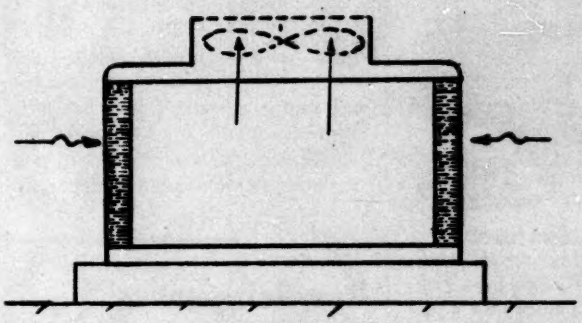


FIG. 5

c. Figure 5 is a sketch of a condenser type where "small boy" damage was not critical. An instantaneous and pleasing reaction is obtained (for the boy), when rocks or sticks are dropped through this grill and into the fan.

d. Another field error which has probably been more costly than all others combined is the location of

NOW TER BUNKER ICING . . . AT LESS COST

with new

Mobil Icer

Truck-mounted Mobil Icer operates in railroad yards, on sidings, at shipper's docks, anywhere a truck can go.

ADAPTABLE TO ALL BUNKER ICING OPERATIONS

Saves valuable time on every job. Eliminates shuttling of cars and break-up of trains for initial icing or re-icing of cars . . . also, most efficient for icing cold storage bunkers and pre-cooling chambers.

FAST TWO MAN OPERATION

Mobil Icer easily handles 300 lb. blocks of ice at the rate of 20 to 25 per minute. Twin-drum design uniformly breaks blocks of ice into an ideal size for bunker icing (approximately 37½ lb. cubes with little or no fines). Hydraulic controls quickly change Mobil Icer to deliver coarse crushed ice for topping off bunkers.

Get the full money saving story.

Write for FREE literature today!

CONVEYCO

THE CONVEYOR CO.

Heat Transfer Equipment

PIPE COILS

Custom Engineered to Your Requirements

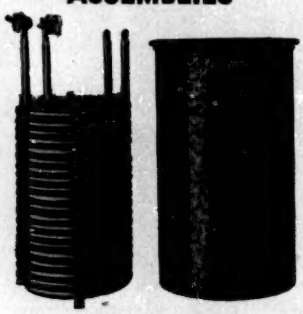
HEAT RECLAIMING UNIT

Typical of the many varieties of coils produced by Rempe from any type of ferrous or non-ferrous pipe and tubing.

Coil illustrated is 15' long with 5" copper headers. Used in floor pit for reclaiming heat from waste process water to preheat boiler feed water. Ideal for reclaiming heat from any hot waste liquid and reducing fuel cost.

Tell us your problem
We'll design the coil

TANK and COIL ASSEMBLIES



For Sub-Zero or High Temperatures

One of many Rempe Coil jobs: This Tank and Coil assembly was built for use with thermostatic expansion valves to dewax oil at minus 35° F. Any diameter or any length to your specifications or our design. Can be supplied in Steel, Alloy, Stainless Steel, Copper or Aluminum.

Engineering Data Book

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REMPE COMPANY

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the Utility room in houses where only indoor access is possible. In the Air Force our people may be away from home a considerable portion of the time depending on their various assignments. This makes servicing difficult, costly, and generally unpopular.

Conclusion

In conclusion I believe my feelings are representative of a majority of Air Force people when I say say we still look favorably on the heat pump system if it is properly engineered and applied. Field application errors are expensive, particularly in housing, where each fumble may be multiplied by a thousand or fifteen hundred.

The one questionable area to which we must yet face up to is maintenance over the "long pull" so to speak. By this I mean over a period of 5, 10 or 20 years. Actual cost data is not yet available, and we may expect to wait some time for it.

There have been some recent developments in moisture indicators which are very promising. I refer here to the new "dry eye" type moisture indicators.

These and other new developments may brighten the maintenance problem appreciably.

How Refrigeration Is Applied

Continued from page 10

the first requirement for the maintenance man is that he be no larger than a jockey. To get to the unit he must parade through the house, through the master bedroom, empty the storage closet of a few chests, bags of golf clubs and portable sewing machines, get down on his knees and crawl through a hole. To replace a cycle it is necessary to take down a living room wall, but fortunately the architect realized this and the wall is a special movable one attached with screws. It is probable that this unit will not be properly maintained and one may suspect any undue or early failures will eventually be to the discredit of the manufacturer.

You can help yourself by helping us. We need strong representation to architects and engineers in the correct manner to apply your equipment. Not just individual pieces of equipment but the combination of all items which make up a system. This is not a plea to do the design work but it is a plea to work closely with A-E's and insist on the elimination of known application errors. A good system must be built up with properly matched components properly applied.

The Department of Defense requires a large amount of air-conditioning. To hold this part of defense spending to the minimum it is imperative that our systems be simple, rugged and effective. In this effort the Department of Defense is hopeful for the continuing support and assistance of the industry.

Personnel Changes At Controls Company

»» THE transfer of one sales engineer and the hiring of another in the Heating and Air Conditioning Controls Division of Controls Company of America, Milwaukee, Wisconsin, were announced recently as part of the firm's continued technical strengthening of its field sales force.

Irving H. Finkler has transferred from his post as sales engineer in the Cincinnati, Ohio, sales office to an equivalent position in the Dallas, Texas, sales office. Prior to becoming a sales engineer, Mr. Finkler was supervisor of the Controls Company refrigeration laboratory for several years.

Replacing Finkler in the Cincinnati sales office is Herbert H. Rauh, former manager of automotive air conditioning control engineering for Robertshaw-Fulton Controls Company. He has also been a Ranco, Inc., project engineer and engineering supervisor of electrical components for Westinghouse Electric Corporation.

Controls Company of America is a leading manufacturer of controls systems for aircraft, guided missile, computer, electronic, vending, air conditioning, automotive, refrigeration, heating and appliance industries. Executive headquarters are at Schiller Park, Illinois, a suburb of Chicago, with manufacturing and sales facilities in a number of major industrial centers across the United States, in Europe and South America.

Industry Meetings

Maintenance — **Jan. 25-28**

PLANT MAINTENANCE & ENGINEERING SHOW
Convention Hall, Philadelphia

Company Truckers — **Jan. 28-29**

PRIVATE TRUCK COUNCIL OF AMERICA, INC.
21st Annual Convention
Roosevelt Hotel, New York City

Air Conditioning Exposition — **Feb. 1-4**

2nd SOUTHWEST MEETING & AIR CONDITIONING EXPOSITION
Memorial Auditorium, Dallas, Texas

Refrigeration & Air Conditioning Engineers — **Feb. 1-4**

AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR CONDITIONING ENGINEERS, INC.
Baker Hotel, Dallas

Poultry Conference — **Feb. 12-14**

INSTITUTE OF AMERICAN POULTRY INDUSTRIES
1960 Fact Finding Conference
Municipal Auditorium, Kansas City, Mo.

Practical Refrigeration — **Feb. 26, 27**

PACIFIC COAST CONFERENCE, NAPRE
CALIFORNIA CHAPTER No. 2
Los Angeles, Calif.

Frozen Food Packing — **Mar. 6-10**

NATIONAL ASSOCIATION OF FROZEN FOOD PACKERS
Conrad Hilton Hotel, Chicago, Ill.

Power Forum — **Mar. 29-31**

ILLINOIS INSTITUTE OF TECHNOLOGY
22nd Annual American Power Conference
Hotel Sherman, Chicago

Air Conditioning Conference — **Apr. 27-30**

WESTERN AIR CONDITIONING INDUSTRIES ASSN.
Shrine Exposition Hall, Los Angeles

Meat Packing — **May 12-15**

NATIONAL INDEPENDENT MEAT PACKERS ASS'N.
Ambassador Hotel, Atlantic City

Air Conditionig and Refrigeration Institute — **May 1-4**

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The Homestead, Hot Springs, Va.

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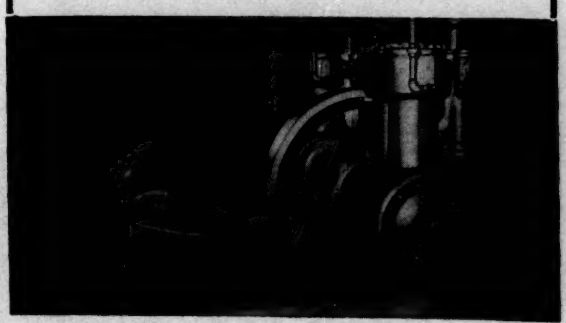


Refrigeration for Bottling Fruit Juices

Those aren't icicles hanging from the ceiling. They are aspirator nozzles. Cold air from the floor unit in the background is distributed from a false ceiling through these nozzles, forcing cold air through crates and cartons of various juice products which are open at the top.

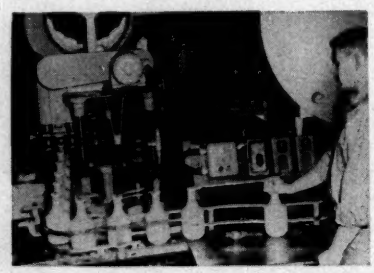
SPECIALIZED refrigeration units in a plant recently placed in operation by Sunnyland Juice Corp., Anaheim, Calif., have virtually eliminated spoilage in the bottling of orange, grape, lemon, and several related types of fruit juice.

Refrigeration is a particularly critical operation in this plant. Juices could be damaged by either too much cold or too much heat, in a relatively short period of time after they are extracted from fresh fruit.

To prevent such damage, the juices are cooled to 30°F with equipment and a system designed by Kohlenberger Engineering Co. York Sweet Water Chillers with High-K cooling plates, and Creamery Package Crescent Plate Heat Exchangers rapidly cool the California fruit juices prior to filling operations. Distribution of these fresh juices is in either glass bottles or waxed paper cartons.

Immediately following the bottling process, the juice-filled containers are conveyed in one-dozen cases or two-dozen cartons to a 38,220 cu. ft. cold storage room. This compartment was designed and built to maintain a close-tolerance temperature of 30°F.

Stacked eight cases high, from 75,000 to 150,000 units are continuously stored in the latter room, and some spoilage could almost invariably be expected if the designers hadn't arranged to have air vents widely distributed throughout the ceiling structure so as to eliminate dead pockets.



Filling half-gallon bottles with California orange juice at Sunnyland Juice Corp. Refrigeration is required between juicing and bottling; for storage prior to delivery.

A floor mounted air cooling coil assembly discharges to a furred ceiling. Vents in the ceiling are equipped with aspirator nozzles which entrain secondary air from within the storage. The nozzles also direct the colder air down through the cases.

Linde Liquid Hydrogen Plant In Operation

»» A NEW liquid hydrogen facility is now in operation at the Tonawanda, New York laboratories of Linde Company, Division of Union Carbide Corporation. Hailed as a major advance in industrial cryogenics, this facility will make substantial quantities of liquid hydrogen available for the first time in the northeastern United States. Deliveries will initially be made in Linde's new highly efficient low-loss liquid hydrogen containers, in quantities ranging up to thousands of liters per truck load.

The unit can produce more than 25,000 liters per month of liquid hydrogen with less than two parts per million impurities. In addition to high purity, liquid hydrogen produced by this unit has high parahydrogen content. Parahydrogen, the stable form of liquid hydrogen, usually may be present in only one-quarter of all hydrogen which is liquefied, but this unit makes a product with a minimum of 95 per cent parahydrogen and 5 per cent orthohydrogen.

Steel Cracks In It

Liquid hydrogen is so cold that many types of steel will crack upon sudden contact with it. Its boiling point of 423 degrees below zero, Fahrenheit, makes liquid hydrogen a valuable tool for cryogenic research in solid state physics, low temperature chemistry, and metallurgy.

Since electrical conductors show a great increase in conductivity when subjected to extremely low temperatures, liquid hydrogen is becoming increasingly important in electrical and electronic research. In addition, the ultra-cold fluid is widely used in liquid hydrogen bubble chambers for nuclear research and for hydrogen-oxygen fuel cell experimentation. Its prime use in large volumes, is as a missile fuel.

Used As Fuel

Termed "the ultimate chemical fuel" by Air Force missile experts, liquid hydrogen delivers about 40 per cent more "specific thrust" than any other rocket fuel known today.

This facility is the product of an extensive pilot plant operation conducted for several years at Tonawanda. It is also the precursor of a large-scale liquid hydrogen plant being built by Linde at Torrance, California to provide the National Aeronautical and Space Administration and other users with tonnage quantities of liquid hydrogen for missile activities.

"Story of Competition in The American Market" Is New Publication

»» FOUR distinct types of competition—two of them arising out of technical progress—characterize the American market today, and give consumers the ruling voice in business activities.

This is the theme of "The Story of Competition in the American Market," published recently by the Du Pont Company. Such widespread competition not only restrains monopoly but gives consumers an unsurpassed choice of selection, the booklet says.

The older forms of competitive activity—direct competition and competition from foreign sources—have expanded greatly, the booklet states. In addition, virtually every product today faces competition from many dissimilar products offered for the same use, and business enterprises must contend with the threat that new competitors may move in unless existing producers operate with maximum efficiency.

The 32-page illustrated booklet shows how technology constantly expands the number and variety of products in the market. It shows how competition has increased in parallel with the growth of industry, bringing to the American consumer the widest choice of products and services, and the most bountiful living standard in history.

"Competition is the nature and rule of life in almost every segment of the American market today," the booklet says. "In each of its forms, it is a vital stimulus to the economy, and the vehicle through which the consumer exercises his control of business enterprise and activity."

Reviewing the forms of today's competition, the booklet notes that in the past, when the population and market were much smaller, competition was largely a matter of individual firms seeking the business that lay within specified regions and product categories.

Today, salesmen from every state and many foreign countries "range the 'territory' at will, carrying an astonishing array of products in their sample cases." Lumber, steel, aluminum, glass, brick, cinder block, cement, fiberboard, and plastic vie for applications in the building market. In the textile field, natural fibers compete with 20 categories of man-made fibers.

"What has happened, quite simply," the booklet says, "is that technology has extended the range of interchangeable products, and built substitutive competition into a major economic force.

"At the same time, businessmen have developed the habit of looking over each other's shoulders, eyeing opportunities for expansion. Unlike their earlier counterparts, many firms have both the technical resources and the money to depart on new tangents. The very fact that they are contemplating such moves is a major incentive driving businessmen to keep their product quality high and their customers happy. If they don't, someone else will.

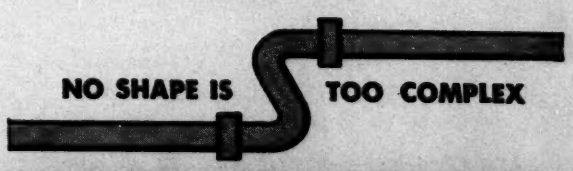
"In addition, direct competition has expanded enormously. Spurred by the rise in discretionary income, by increasing imports from Europe and Japan, and by the increased mobility of the consumer, it is a far livelier economic force than was the leisurely, casual competition of the past."

Large and diverse as the American market is today, the booklet says that it may be expected to grow to "far more astonishing proportions" in the future, because of rising population, rising personal income, and rising output of goods and services.

"Given the economic, social and political conditions which have stim-

lasts a lifetime!

Genuine Ozite pipe covering insulation installs easily on curves, fittings, straight pipes or valves . . . stops wasteful heat absorption effectively and permanently. Ozite insulation also helps maintain uniform temperature and increase your equipment's refrigerating capacity. Try Genuine Ozite!



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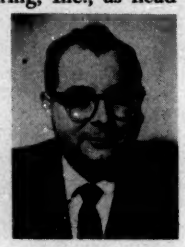
ulated its past growth," the booklet says, "the market of tomorrow will certainly be even larger and more diverse than it is now, and equally as consumer centered.

"If businesses are encouraged to expand with the nation's needs, and if the market is kept free from arbitrary restraints and intrusions, the American consumer can expect in the future a broader and more diverse selection of goods than is evident today, and an even greater measure of the competition that has done so much to raise the living standards in the past."

Sid Shapiro Is Appointed Vice President Of Tenney

>>> SID Shapiro, of Westfield, N. J., has been promoted to vice president of Tenney Engineering, Inc., as head of the company's expanded heat transfer components division, Monroe Seligman, president announced. Tenney's home office, where Mr. Shapiro makes his headquarters, is in Union, N. J.



Sid Shapiro

Mr. Shapiro joined Tenney, a major manufacturer of environmental test chambers as well as of coils for heating, air conditioning and refrigeration equipment, in 1945. After working on all phases of coil production and assembly, he became a salesman and then sales manager.

With Mr. Shapiro in charge, the heat transfer components division, which sells to wholesalers and original equipment manufacturers, expanded into a plant in (2235 Sission St.) Baltimore. Now a second plant is under construction for the division in Wilmington, N. C.

Born in Akron, Ohio, Mr. Shapiro was reared in Newark, N. J., where he was graduated from Central High. In the army from 1942 to 1945, he saw action in Germany, was wounded, and was awarded the Purple Heart with oak leaf cluster.

Mr. Shapiro is an associate member of the American Society of Refrigeration Engineers and a member of the Garden State Chapter of the Refrigeration Service Engineers Society.

With Mrs. Shapiro and their three children, he lives in Westfield at 68 Genesee Trail.

Bell & Gossett Develops Promotion Program To Help Builders

>>> A MAJOR promotion program designed to produce sales for builders of "Hydronic Homes" has been developed by Bell & Gossett Company, Morton Grove, Ill., manufacturers of hot water heating and air conditioning equipment.

According to Philip C. Kosch, field promotion sales manager, the promotion program helps solve two principal problems for builders: (1) create traffic through the model home, and (2) provide a distinctive feature which identifies the model, the builder's name, and the home's location in the mind of a prospect so he will revisit and purchase.

Hydronic homes, which are being constructed all over the country, are noted for their complete freedom of home design, more beautiful interiors, greater health and safety, and permanence of investment.

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AMMONIA VALVES AND ACCESSORIES
Now available in a complete size range—flanged globe and angle valves with forged steel flanges in F. P. T., socket-weld and welding neck types. Other Henry products include globe and angle shut-off valves; ASME approved relief valves; dual relief valve assemblies; forged steel flanges, unions and fittings.
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WRITE . . . WIRE OR PHONE . . . NOW

K. G. BROWN MFG. CO., INC.
WICKHAM AVE., MATTITUCK, N. Y.

Principal feature of Hydronic homes is a circulated water heating system in which heated water is circulated through separate circuits of small pipes, thus establishing controlled comfort conditions in every area of the house. The system can also be used for air conditioning.

To help solve the two builder problems, Bell & Gossett has developed a seven-step program involving numerous printed materials which are available to the builder at nominal cost.

Amoroso To Manage Tube Manifold Plant

»» ANNOUNCEMENT of the appointment of John D. Amoroso, as plant manager has been made by Clark D. Matthews, president of Tube Manifold Corporation, North Tonawanda, New York. Mr. Amoroso has had 20 years experience in engineering and plant management.

He received his BS degree in mechanical engineering and electrical engineering from Carnegie Institute of Technology. He is a member of the Buffalo Chamber of Commerce, The Society of Automotive Engineers, The Engineering Society of Buffalo Inc., The American Society of Mechanical Engineers and the Institute of Radio Engineers.

The Tube Manifold Corporation manufactures liquid receivers as well as filter-driers for the refrigerating, air conditioning and automotive industries. Recent developments include a spherical disposable metal container used for hand held oxygen resuscitators and fire extinguishers. These spherical containers are made for working pressures up to 1750 lbs.

The TMC cylindrical disposable containers are a popular product in packaging liquids and gases used in industry and homes.

Drayer-Hanson Starts 50th Year Plans

»» HISTORY repeats itself! ". . . Sometimes, just at the right moment!", claims Harold T. Hunt, general manager, Drayer-Hanson, in Los Angeles.

Hunt's firm is gearing up to celebrate its 50th Anniversary Year in 1960—they started back in 1910 as a fabricator of refrigerated truck bodies.

The interim period has seen D-H become a major supplier of air conditioning and refrigeration products to the domestic and foreign markets.

Last week, however, according to Hunt, a contract originating from Air Logistics Corporation, Pasadena, caused everyone at the mainplant facility to do a "double take."

Called for—for the first time in several decades—was an order for fabrication of truck cabs, in this application to be used in conjunction with portable test gear.

"Guess you just can't live down a good reputation," avers Hunt—"even after fifty years!"

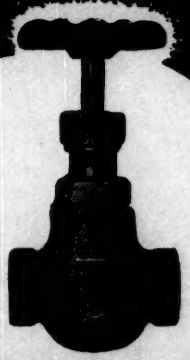
"We of course intend to capitalize upon this timely—if fleeting—return to the seat of our company success," Hunt concludes. "It supplies us with ideal promotional fodder for our forthcoming 50th-Anniversary Jubilee celebration."

Large Induction Motors

A MILWAUKEE manufacturer recently announced the availability of a new line of large induction motors in open drip-proof enclosures, from 150 to 2,000 hp at 1800 to 3600 rpm. These motors will serve as drives for pumps, fans, blowers and compressors, with a number of applications being made in air conditioning and refrigeration plants.

Efficient Designs For Long Life And Low Maintenance

SHANK AMMONIA VALVES



Shank Valves have earned a reputation for high quality, long life and dependable products.
Built of highest grade materials with close tolerances—will stand most rigid inspections.
Largest line of Ammonia All-Steel Bar Stock Valves in the industry.
Completely Cadmium plated.

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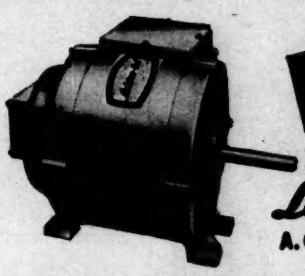

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- Power also available for heating, auxiliary lighting, pumps, etc.
- Kit furnished complete with all necessary parts for ease of installation.
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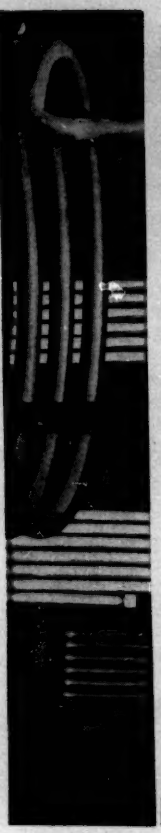

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John F. Tobin Named V.P. For American-Standard

>>> APPOINTMENT of John F. Tobin as vice president-marketing has been announced by A. O'B. Andrews, president of American-Standard Industrial Division, producer of air conditioning and air handling equipment, air pollution control equipment, fluid drives, heat transfer products, surface condensers, steel boilers and related industrial products. The division has executive offices and a plant in Dearborn, Michigan with additional plant facilities in San Leandro (Calif.), Columbus (O.), Kewanee (Ill.) and Buffalo (N. Y.).

J. F. Tobin

Mr. Tobin is a University of Illinois graduate with a degree in mechanical engineering. He has been with American-Standard since 1923 and has served in a variety of sales management positions during this time. In his new position, Mr. Tobin will direct the division's complete marketing program. Prior to accepting his new assignment, Mr. Tobin had been a regional manager for the Industrial Division. He is a member of A. S. H. R. A. E., A. S. M. E. and the Industry Committee of the American Power Conference.

Mr. Tobin's appointment fills a vacancy created by the retirement plans of E. W. Petersen, who has served as vice president-marketing for the past 3 years. Mr. Petersen will remain a vice president and marketing consultant to the division until January 1, 1961, the effective date of his retirement after 37½ years service with the corporation.

Bohn Promotes Two

>>> GUY H. Pitts, vice president of manufacturing, Bohn Aluminum & Brass Corporation, has announced the appointment of Edward N. Harris as manager of Bohn Plant No. 12 at South Haven, Michigan. Harris formerly supervised Bohn's sales and engineering contacts with several General Motors manufacturing divisions.

Richard C. Aylward, Bohn's vice president of sales, has announced that Robert W. Johnston has been appointed to supervise the same General Motors accounts formerly handled by Harris.

Harris holds a mechanical engineering degree from The University of Michigan. Before joining Bohn six years ago, he was employed by the Buick Division of General Motors Corporation as a product design engineer.

Johnston also is a graduate mechanical engineer of the University of Michigan and is well known throughout the Greater Detroit, Flint, and Lansing areas. He has been identified with industrial sales to the automotive industry for the past 13 years. Both men are long time residents of the Flint area.

Bohn operates 10 plants in Michigan, Indiana, and Illinois and maintains sales offices in all major cities. Bohn's products include bearings and pistons, aluminum castings, aluminum and brass extrusions and forgings, brass rod and shapes, brass and bronze ingot, and refrigeration and air conditioning products. Bohn also owns two subsidiaries: Plastray Corporation at Walled Lake, Michigan which manufactures plastic housewares; and the Port Everglades Steel Corp. at Fort Lauderdale, Florida which imports steel products used in the building and highway construction industries.

Rodgers Engineering Becomes Representative For Recold

>>> RODGERS Engineering Company, Inc. of Dallas, Texas, has been designated by Recold Corporation as a representative for its line of air conditioning products, it was announced by Walt Hilton, western sales manager of Recold.

Fred A. Rodgers, owner of Rodgers Engineering, has been actively representing air conditioning products since 1939. He is a graduate of the University of Minnesota, and a member of ASHRAE.

Vice-president of the firm is Frank G. Brunner, also a member of ASHRAE. Sales manager for Rodgers Engineering is Robert Breese.

Rodgers Engineering Company also maintains a representative in Fort Worth, Texas, and plans to add another in a new location early in 1960.

Literature On Insulation

>>> THE Uni-Crest Division of United Cork Companies announces a new 8-page circular which discusses Uni-Crest, its brand of expanded polystyrene insulating material. The brochure describes the product, lists its physical properties, gives standard dimensions, and recommends thicknesses for a wide range of temperature conditions. Photos and drawings illustrate its various uses and the text discusses simplified techniques of installation and finishing.

Among the detailed specifications given are those for installation under concrete slabs, in crawl space, in cold rooms, in masonry walls, as free standing slabs, and for pipe covering. To obtain your free copy, write to: Uni-Crest Division, United Cork Companies, Dept. P, Kearny, New Jersey.

New Ammonia Agent In Philadelphia

››› SALT Service Inc., of Philadelphia, Pennsylvania has been appointed agent by Allied Chemical Corporation, Nitrogen Division to handle Anhydrous Ammonia in cylinders.

Stocks for the Philadelphia area may be ordered from their office at Jefferson and Creighton Streets in Philadelphia.

Metal Corrosion Prevention Catalog

››› A SIMPLE, economical way to prevent metal corrosion is the subject of a new 8-page, 2-color catalog just released by Corrosion Reaction Consultants, Inc., Philadelphia, Pa.

Called CRC 3-36, this new liquid formula is useful in both metal manufacturing and metal maintenance. It successfully prevents corrosion of iron, steel, aluminum, copper, brass, magnesium and other commonly used metals. It checks corrosive deterioration of bare, plated or painted metal surfaces . . maintains tools, instruments, dies, fixtures, jigs and precision-machined surfaces. CRC 3-36 has great penetrating power and is particularly effective in loosening, turning or sliding parts "frozen" by corrosion.

The folder explains how CRC 3-36 works, how it is applied, its duration of effectiveness and gives details of its physical specifications. A number of typical CRC 3-36 applications are included to illustrate the range and versatility of this preventative and restorative.

General Controls Offers Industrial Controls Catalog

››› GENERAL Controls Co.'s newest Industrial Controls Catalog is now available for distribution, according to J. F. (Jack) Ray, vice president charge-of-sales.

Combining information from several other catalogs to present a comprehensive line, the new publication lists many well-known General Controls products, including automatic temperature, pressure, level and flow controls, as well as counters, switches and automation controls.

Other items illustrated and described are industrial actuators, combustion instrument controls, controller indicators and pressure indicators. There is also a section presenting the famous General Controls "Hydramotors," electro-hydraulic actuators having many patterns, designs and valve body materials.

The Hammel-Dahl Division and Foster Engineering Division lines, as well as relays, transformers, and time switches, are also shown in the new booklet.

Copies of the publication are available without charge. Write on company letterhead to Literature Control Section, General Controls Co., 801 Allen Avenue, Glendale 1, California.

Cooling Tower Bulletin Released

››› NEW Bulletin No. KT-104 describing the Kennard/Nelson Cooling Towers, Induced Draft, has been released by American Air Filter Co., Inc. The bulletin explains the construction, specifications and performance details for the cooling towers with a centrifugal-type fan for quiet indoor and/or outdoor operation. Particular attention is given to the centrifugal-type fan, the fan motor, mounting base and V-belt drive, "Z"-formed eliminators, wetted deck surface and the one-piece welded sump pan.

Kennard/Nelson Cooling Towers are furnished in three sizes to meet the demand for water cooling of packaged air conditioners, both in business and home, and for small industrial and refrigeration requirements. Capacities for the KT models range from 7.5 tons to 25 tons. Other models range in capacities from 15 to 75 tons.

The galvanized steel cabinet is covered on the exterior with aluminum paint. The interior is spray coated with asphalt and an asbestos fiber material for sound-deadening and further rust-proofing. The sump pan is hot-dip galvanized after fabrication. The motor has ventilated weather protection.

Bulletin No. KT-104, describing the Kennard/Nelson Cooling Towers is available upon request from Dept. PD, American Air Filter Co., Inc., 215 Central Avenue, Louisville 8, Kentucky.

Classified Advertising

Position and Help Wanted

REFRIGERATION SALES ENGINEER

Rapidly expanding, well established West Coast industrial refrigeration manufacturer has excellent opportunity for aggressive sales engineer. Must have engineering degree or equivalent; minimum of three years refrigeration sales engineering experience in quick freezing, cold storage and process refrigeration. Most important, must be aware of dynamic potential of the industrial refrigeration industry. Excellent salary and commission; outstanding company benefits; car allowance and expenses. Send detailed resume to C. R. Kohlenberger, president.

KOHLENBERGER ENGINEERING CORPORATION
1600 W. Commonwealth Ave. P.O. Box 432
Fullerton, Calif.

USED EQUIPMENT—wanted & for sale

REFRIGERATION EQUIPMENT FOR SALE
Advise Us Your Needs
Use QUICKSEAL—stops brine tank leaks.
Use CLERTEMPICE—clears and tempers ice.
Born Company 80 East Jackson Boulevard.
Chicago 4, Illinois. WAbash 2-8299.

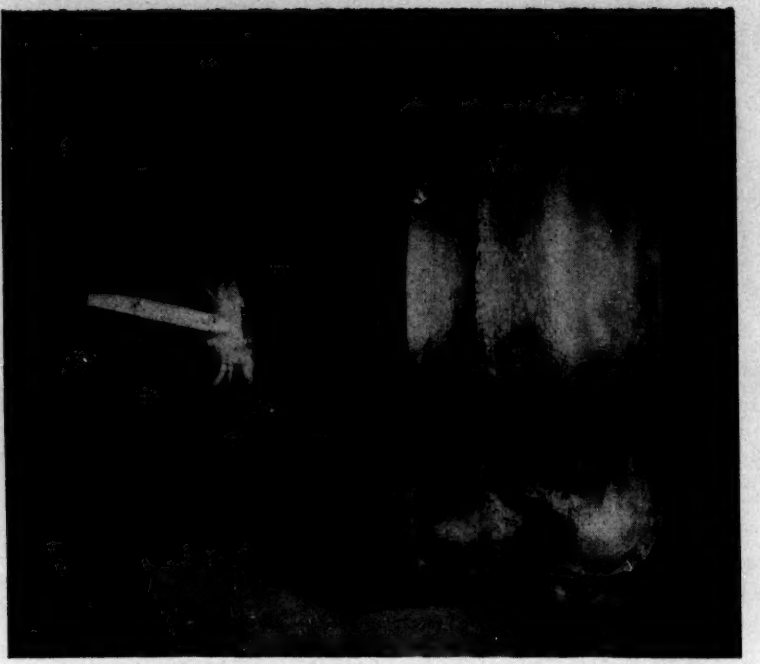
FOR SALE—4 new main bearings and two complete sets of outboard bearings for 6x6 York ammonia compressor. Gus A. Regnier, P. O. Box 1093, New Haven, Conn.

WANTED—Used compressor with motor and starter; about 360 r.p.m. Phone or write Independent Ice Co., 602 N. Albany Ave., Tampa, Fla.

FOR SALE—one 40 ton Lipman ammonia compressor and wheel, Model 4010, never used. Hepworth Farms, Milton, New York.

FOR SALE
10x10 York V-belt drive 125 h.p.
(2) 1½ h.p. ammonia cold air diffusers.
(1) 9x9 York & (1) 7x7 Frick compressor.
(2) 8½ KW Electric Machinery MG sets.
Type 100 F & E automatic ice cuber.
30 ton York ice making plant.
(2) 11x9 York compressors 60 h.p. ea.
JOHN F. CARSON
A & Venango Sts. Philadelphia 34, Pa.
GArfield 6-2221

FOR SALE — AMMONIA EQUIPMENT
3—15 ton complete Frick ice making plants, new, in crates, no air system, sold as used.
2—10"x10" 4 cyl. Carbondale duplex DC to 225 h.p. 300 r.p.m.
1—9"x9" 4 cyl. York duplex DC to 150 h.p. motor, 300 r.p.m.
2—9"x9" 2 cyl. York DC to 75 h.p. motor.
1—10"x10" 2 cyl. York DC to 125 h.p. motor.
1—9"x9" 2 cyl. Frick compressor.
1—6½"x6½" 2 cyl. York compressor.
1—3"x3", 1—4"x4", 2—5"x5" condensing units.
2x3", 4x4", 5x5", 6x8" compressors.
11x22x51" 300 lb. ice cans, also 11x22x47" ice plants, 25 to 100 ton capacity, complete.
10 shell & tube condensers, 25 ton capacity.
1—800# Gifford Wood cubing machine.
ENTERPRISE EQUIPMENT CORPORATION
238 Bryant Ave. Bronx 59, N.Y.
Cable ENTREMA Phone DA 8-2121



Why United's patented process results in corkboard of higher insulating value

Cork in its natural state is well known and highly regarded as an excellent insulating material. However, by an exclusive blocked-baked patented process that combines *both* external and internal heat in the moulding operation, United BB Corkboard is unsurpassed in insulating value.

Further, United Corkboard is 100% cork . . . with no filler added, and, its high strength in relation to light weight permits a sturdy self-supporting structure that is simple to erect. It's flexible too . . . fits accurately, works as easily as lumber and the natural resins released during processing further add to its excellent moisture resistant characteristics.

The next time you have a need for low temperature insulation investigate the unique combination of benefits only "patented process" United Corkboard can provide.

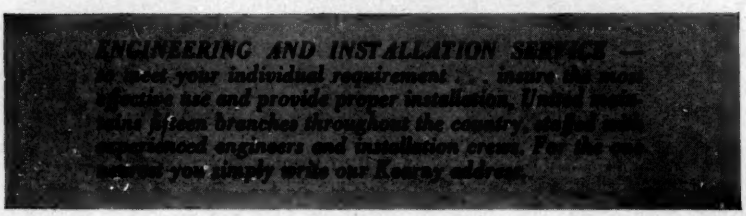
Write today for specifications and helpful installation data. No obligation.

UNITED BB CORKBOARD

UNITED CORK COMPANIES

Since 1907

4 Central Avenue, Kearny, New Jersey



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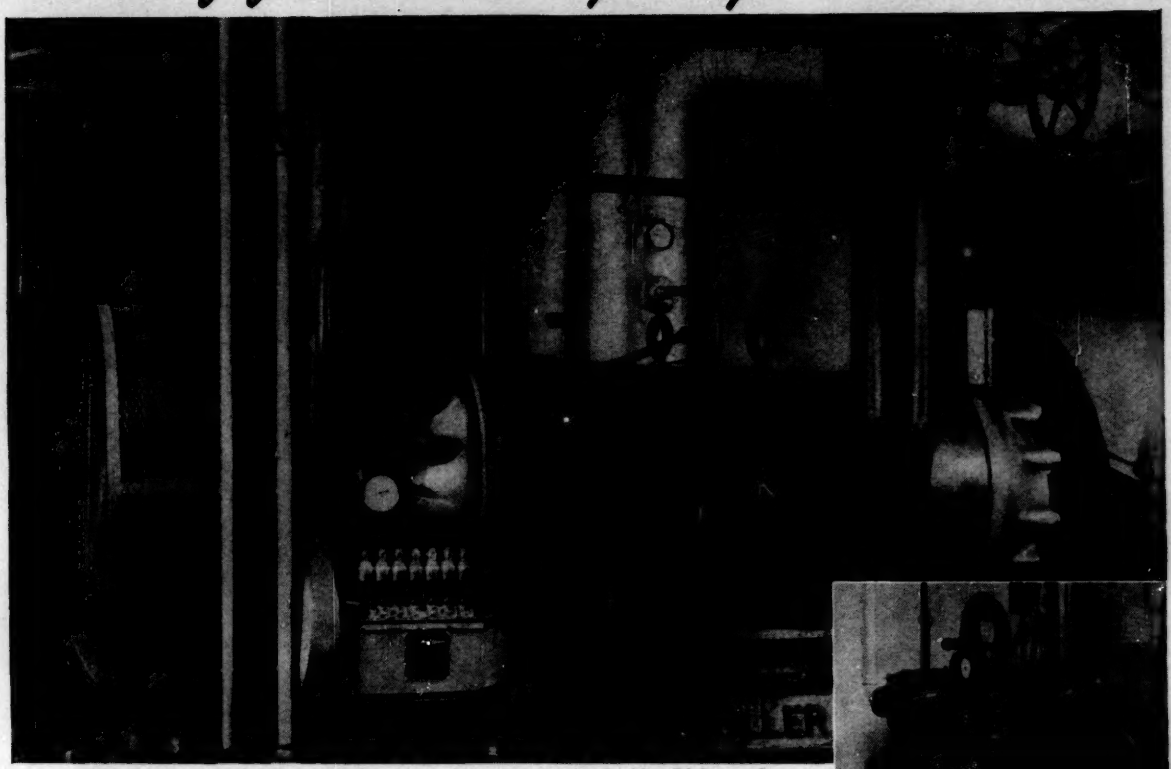
More Proof of FES-FULLER *Superiority*



"FES-Fuller type A-250 rotary booster compressor nearly doubles Liebmann's freezing capacity," says Herb Liebmann, Jr., of Liebmann Packing Co. Adding 100 tons of refrigeration to 110 tons supplied by existing reciprocating booster, vibrationless rotary takes light foundation—which cuts this installation cost 25%.

HIGH 6-YEAR PERFORMANCE RECORD of this Fuller C-50 rotary compressor supplying plant air led Liebmann to investigate and buy FES-Fuller rotary booster unit. Design principle is identical with that of booster units, using only 3 moving parts: rotor, sliding vanes, and bearings.

"VALVELESS" ROTARY BOOSTER COMPRESSOR CUTS INSTALLATION COST 25%

Designed without suction or discharge valves, an FES-Fuller rotary booster compressor can work more efficiently at low pressure and high gas volume than comparable types. Thus, in a two-stage system like the one at Liebmann's Green Bay, Wis. plant, even very low pressure differences can't hinder its output. Efficiency actually *increases* when system pressure drops.

Liebmann discovers extra benefits. "We wanted a compressor to handle high volumes of low-pressure suction gas in the primary phase of our recently expanded freezing system. The machine had to be rugged and trouble-free, keep original capacity for life, and be easy to install," states Herb Liebmann. Besides meeting these specifications amply, the 100-ton FES-Fuller unit takes only 10 x 12 feet of engine-room space, and cuts estimated installation cost by 25%. A light foundation is all that's needed, since rotary compressors work without vibration.

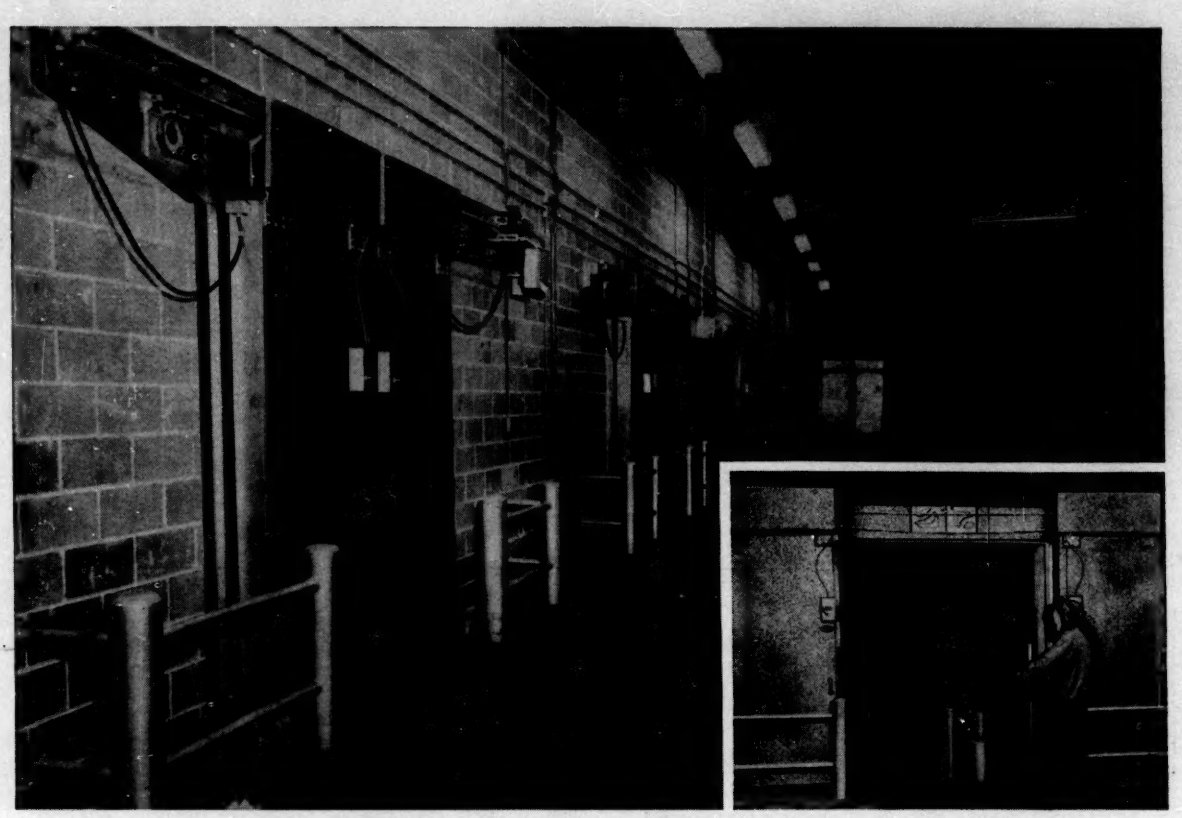
Advantages like these can be yours with FES-Fuller rotary boosters. Their simple, compact design gives big savings in space, power, money and maintenance time. They can run with almost no supervision. Patented jacket cooling of FES-Fuller rotaries eliminates freezeups. Consult FES-Fuller on the best ways to add to your freezing capacity or to design profitable new facilities. Freezing Equipment Sales engineers are always ready to help you. Write today for information and detailed literature on FES-Fuller rotary booster systems.

FES FULLER 1343 C-342

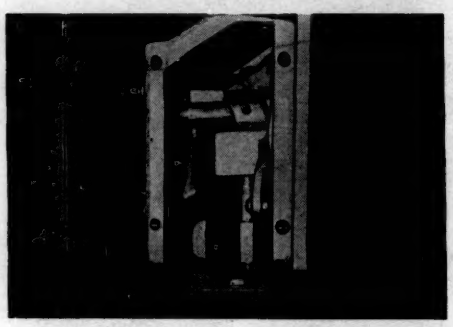
FREEZING EQUIPMENT SALES, INC., 1405 N. DUKE Street, YORK, PA.

Qualified distributors in principal cities

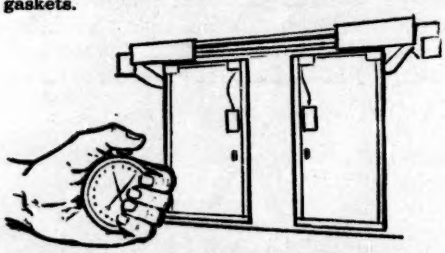
LOW TEMPERATURE FREEZING EQUIPMENT



9 Jamison Electroglide® Doors handle heavy traffic—save refrigeration



COMPRESSION SEAL—refrigeration savings assured by cam lock—in and down action on gaskets.



SMOOTH, SHOCK-FREE OPERATION—exclusive Electroglide spring cushion chain link absorbs inertia on opening, absorbs momentum when stopping.

Insulator: Mid Continent Industrial Insulation Co., Kansas City, Kansas.

Contractor: A. W. Soderberg Construction Co., Wichita, Kansas.

• In Wichita, Kansas, at the big Safeway Cold Storage Warehouse, nine Jamison Electroglide Power Operated Cold Storage Doors demonstrate how they permit high volume, high speed warehouse operation.

Exclusive Jamison features of the Electroglide assure fast, positive operation with safety to personnel.

LEVEL RIDE—opening and closing without gasket wear or drag.

RANGE OF TYPES—available bi-parting and single leaf left or right hand operation.

PADLOCK WITH SAFETY—emergency inside release.

MANUAL OPERATION—possible when power is off.

For Electroglide bulletin—Write Jamison Cold Storage Door Co., Hagerstown, Md.

JAMISON

COLD STORAGE DOORS